THURSDAY, JUNE 16, 1870

## THE SCIENTIFIC EDUCATION OF WOMEN

THE feature which will probably most clearly mark the year 1869 in the view of the future historian of Education, will be the definite recognition of the rights of woman to all the advantages of education accorded to men. The advance of public opinion within the last few years on all subjects relating to the legal, social, and educational position of woman, has indeed been so rapid, that the man whose words were only quite recently listened to by his friends with a condescending smile of pity, is now scarcely in advance of his times. As it is generally believed that the movement has yet far from reached its full development, and the course in which it has been so far directed having been in the main sound and excellent, we would still wish to suggest to its promoters whether the curriculum of subjects taught under the auspices of the various associations may not be somewhat widened by a more liberal infusion of the scientific element. The ability of women to appreciate instruction by the highest teachers of Natural Science has as yet hardly been tested. The high position occupied by a few women like Miss Martineau and Mrs. Somerville as writers on Political and Natural Science cannot be taken to prove the capacity of the whole sex; but we think that so far as opportunity has yet been offered, the evidence is entirely favourable. The programmes of the Lectures to Women on Physiography, Physics, and Botany, recently delivered at the South Kensington Museum by Professors Huxley, Guthrie, and Oliver, show at least no want of confidence in the capacity of their pupils. The first of these courses had already been given substantially to a mixed class of boys and girls at the London Institution, and in the results of the examination of that class, the girls had decidedly the advantage over the boys. In most of the large towns of Great Britain courses of lectures to ladies have now been delivered during the last two or three years by eminent professors of the various branches of literature; in many of these rigorous examinations have been held at the close of the courses; and where this has been done, there is but one expression of opinion as to the quality of the work executed. At London, Edinburgh, Manchester, Liverpool; in English literature, mathematics, experimental physics, mental philosophy, the testimony is uniform, that not only can women compete with men in the qualities essential for severe and successful study, but that in many respects their average attainments are higher than among the working members of a University. A careful examination of the reports of the various educational associations convinces us that this statement is decidedly within the mark. Among so many testimonies to the same effect, it seems almost invidious to pick out one; but we cannot forbear quoting from Professor Fraser's report of his class of logic and mental philosophy at Edinburgh:—"Sixty-five students enrolled. Forty-eight of these shared more or less in the examinations and essays of the class. I found, as the session advanced, that I had at the outset underrated the mental power and persistency of as able and zealous a set of students as I have ever had the good fortune to conduct. . . In the examination the average of marks gained was about 55 per cent.; one-twelfth of the class gained more than 80 per cent. of the marks, and only one had less than 25 per cent."

The Edinburgh Association stands out from most of its kindred societies in being formed on a decidedly more academical basis. The courses are longer, averaging about forty lectures each, and, consequently, deeper and more thorough: the teachers are all university professors, and the aim of the Association is, as it were, to form a distinct Faculty of the University. So far as we can judge, the success of the Association has justified the views of its founders. Many advantages no doubt result from immediate connection with a great centre of learning like the University of Edinburgh, a connection which has hitherto been denied to female education. We are inclined to think that the "College for Women" may have made a mistake in establishing itself in a locality "midway between London and Cambridge." The College will not share in the life of the University; the Cambridge professors will not feel the Hitchin College a portion of their own system, unless the College is locally associated with the University.

We have already alluded to the comparative absence of Natural Science from the programmes of the Ladies' Educational Associations; this is not so strikingly the case as it was last year. The London Association is making arrangements for some scientific classes next session; at Edinburgh Professor Balfour is trying the experiment of a class of botany; classes for zoology and geology are included in the Manchester curriculum for 1870-71; as well as one on logic by Professor Jevons; Natural Science has a place both in the entrance examination for the Hitchin College and in the College course, though it has not yet been taught; while chemical classes have already been conducted in several localities by Professors Williamson, Roscoe, and others, with marked success. We notice with great pleasure the movement at Cambridge for the instruction of women to which we have referred elsewhere. Here a wide field is opening for the future, and one which it will surprise us if women do not make especially their own. In the training of boys we have recently awoke to the discovery that a complete education implies something more than an intimate acquaintance with two dead languages. There is no danger that we shall ever underrate the value of a critical acquaintance with Latin and Greek, as requiring a mental training which no other studies can give; but while a classical education imparts the highest culture possible to the intuitive faculties, it scarcely brings into play the powers of observation. Now, it is in these very powers of perception, as distinct from conception, which the Natural Sciences cultivate, that woman has naturally the advantage over man; and we may therefore *a priori* conclude that their study will be specially within the range of her powers. Another consideration is also worthy of notice by those who are looking for "new careers for women." At a time when we are beginning to recognise the importance of a scientific training as an essential portion of a liberal education, we find that our teaching powers fail us. The number of really competent teachers of science has by no means kept pace with the extension of a desire for instruction; the leading men in every branch are overwhelmed with work; and the younger men to whom they can with confidence entrust

a portion of their labours are by no means sufficiently numerous. It is thus not women only, but men, the whole human race, that is stunted in its intellectual development at a time when its growth should be the most rapid, by the practical restriction to one half of the race only, of the means of acquiring the ability to help in this development.

We must next touch upon a subject of great delicacy; we refer to the instruction of women in medicine and surgery. There is an important distinction between this and all other departments of science. While it is competent to any one to teach chemistry, geology, or botany, and his success as a teacher will depend on his competency, the teachers and practisers of medicine and surgery form a guild, a professional trades' union, protected and licensed by the Government. It is in the nature of guilds and monopolies to be exclusive; and when we find that the medical profession is united almost as one man (with a few honourable exceptions) to resist the admission of women into its ranks, it is only what might with confidence have been predicted. The instinct of self-defence is a strong one; and if any evidence is required of the extent to which self-interest has entered into the causes of the opposition by the profession to the medical training of women, we need only refer to the "seven reasons against the admission of ladies to the profession" given in the *British Medical Journal* for May 7th. Into the abstract question of the utility of monopolies we need not enter; those who are excluded from their benefits are perfectly justified in using every legitimate effort to overthrow them, and in claiming the assistance of those who believe in the universal adaptation of the principles of free trade. Seldom have greater persistence and self-denial been shown than by those few women who have laboured long and hard in this country, America, and France, in attempting to open to their sisters the doors of the medical profession. Careless of cruel misrepresentation, of public slander, of private persecution, they have held nobly on their course, and their services to mankind will one day be recognised.

Few have yet realised the enormous gain that will accrue to society from the scientific education of our women. If, as we are constantly being told, the "sphere of woman" is at home, what duty can be more clearly incumbent upon us than that of giving her the opportunity of acquiring a knowledge of the laws which ought to guide her in the rule of her house? Every woman on whom the management of a household devolves may profit by such knowledge. If the laws of health were better known, how much illness and sorrow might be averted! What insight would a knowledge of chemistry afford into the wholesomeness or unwholesomeness of different articles of food! What added zest would be given to a country walk with the children, or a month by the seaside, if the mother were able to teach the little ones intelligently to observe and revere the laws of Nature! Above all, what untold sufferings, what wasted lives, are the penalty we have paid for the prudish ignorance of the physiology of their bodily frame in which we have kept our daughters! These considerations have had far too little place with us at present.

We trust that a new era is dawning upon us; may the higher education of women be pursued in the admirable spirit of the last report of the Edinburgh Ladies' Educational Association:—"So far as we can see, cultivation does for women what it does for men—intensifies every moral attribute in proportion to the mental growth. Those who must go out into the world go out with a truer courage, founded upon a nobler estimate of work; those whose duties lie within the circle of home find them invested with a new and vivid significance from the higher elevation, and consequently larger views, of their own minds; and, finally, as 'woman is not undeveloped man,' we believe that womanhood can only be made more truly womanly, as manhood is made more truly manly, by the utmost use of the possibilities of high cultivation."

## *NATURAL HISTORY COLLECTIONS*

ALLOW me to give in my adhesion to the "platform" established by the signers of the Memorial concerning the Natural History Collections, reprinted in your last number, and at the same time to request you to reprint a second Memorial on the same subject, presented in 1866 to the then Chancellor of the Exchequer. You will observe that this Memorial has likewise been signed by many distinguished men of science.

P. L. SCLATER

*Copy of a Memorial presented to the Right Hon. the Chancellor of the Exchequer*

SIR,—It having been stated that the scientific men of the Metropolis are, as a body, entirely opposed to the removal of the Natural History Collections from their present situation in the British Museum, we, the undersigned Fellows of the Royal, Linnean, Geological, and Zoological Societies of London, beg leave to offer to you the following expression of our opinion upon the subject.

We are of opinion that it is of fundamental importance to the progress of the Natural Sciences in this country, that the administration of the National Natural History Collections should be separated from that of the Library and Art Collections, and placed under one officer, who should be immediately responsible to one of the Queen's Ministers.

We regard the exact locality of the National Museum of Natural History as a question of comparatively minor importance, provided that it be conveniently accessible and within the Metropolitan district.

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London, May 14, 1866

## FOSSIL MAMMALS IN NORTH AMERICA

*The Extinct Mammalian Fauna of Dakota and Nebraska; together with a Synopsis of the Mammalian Remains of North America.* By Dr. Leidy. With an Introduction on the Geology of the Tertiary Formations of Dakota and Nebraska; with a map. By Dr. Hayden. (Philadelphia, 1869.)

DR. LEIDY'S new work on the extinct mammalia and fauna of Dakota and Nebraska, to which is appended a Synopsis of the Mammalian Remains of North America, fills a wide gap in Palæontology. It occupies the whole of the seventh volume of the Journal of the Academy of Natural Sciences of Philadelphia, and is accompanied by a preface on the geology of the Tertiary Strata of Dakota and Nebraska, by Dr. Hayden. Altogether it forms the most important contribution to our knowledge of fossil mammals which has been made since Prof. Gaudry published his famous "Animaux Fossiles et Geologie de l'Attique." These two books, indeed, stand in close relation to one another, for in the one the chief interest centres in the Miocene fauna, which is the subject matter of the other. I propose to give an outline of Dr. Leidy's work, and to show the relation which the American Mammalia bore to those of Europe, from the Miocene down to the "Quaternary," or Post-glacial epoch.

At the close of the Cretaceous period, writes Prof. Hayden, the ocean which had "rolled uninterruptedly across the area now occupied by the Rocky Mountains" began to grow shallow, until at last a long barrier of land gradually rose above the waves, and separated the Atlantic from the Pacific. This elevatory movement culminated in the Rocky Mountain range in the United States, and probably has been going on from the Cretaceous period down to the present day. In the early Tertiary epoch enormous lakes occupied the basin of the Mississippi. The "great lignite basin," for instance, extends far southward, possibly even to California, westward far over the mountains to Utah, and possibly to the Pacific, and northward probably to the Arctic Sea, interrupted here and there by the upheaval of mountain ranges." The strata which testify to the former existence of this great lake, consist of layers of clay and sand, and numerous beds of lignite, varying in thickness from a few inches to twelve or fifteen feet. In its lower portion an oyster is the characteristic fossil, which by its stunted growth implies a change from salt to brackish water, while in the rest of the formation there are freshwater shells of the genera Melania and Corbicula. "The occurrence of immense fan palms, and many other plants now growing only in tropical climates, points directly to the conclusion that along the shores of this great lake there grew most luxuriant forests, equalled only by those now existing in Central America or Brazil." The date of this lignite formation is possibly Eocene, and certainly pre-Miocene. Some of these lakes continued to exist as late as the Pliocene epoch.

The "White River group" of rocks consists of white indurated clays, sandstones, and conglomerate marls and sands, upwards of a thousand feet thick, which occupy an area of at least 100,000 square miles on the Eastern flank of the Rocky Mountains. It is purely a fresh-water formation. In Nebraska it is eroded by pluvial and torrential action into quaint pinnacles and fantastic shapes of every sort, and into deep barren ravines that recall to mind Dr. Falconer's description of some parts of the Sevalik Hills. From the difficulty of traversing the 5,000 square miles which are cut up in this way the district is known to the Canadian voyagers as "Mauvaises Terres," and to the Indian hunters as the "Bad Grounds." It has furnished the larger portion of the Mammalia described by Dr. Leidy, and is unequivocally of Miocene Age. The Loup River Strata resting on the White River group, consist of sand and a few layers of limestone, and contain the remains of land and fresh water Testacea and Mammalia. In Nebraska, the sand is so incoherent that it forms a series of ever shifting dunes, which occupy an area of not less than 20,000 square miles. The remains of Elephant and Mastodon and others show that it belongs to the Pliocene, irrespective of the stratigraphical evidence. The Post-tertiary deposits are represented in the same region by a yellow siliceous marl, most fully developed along the Missouri River, and in the valley of the Plate. It is from three to five hundred feet in thickness, and contains well-known Post-glacial fossils.

In treating of the Mammalia yielded by these different formations, Dr. Leidy has followed the example of Prof. Agassiz in the needless multiplication of species. Naturalists fall into two classes, according to the ideas which they bring to bear on their work: the one fix their attention on the variability and points of resemblance manifested by suites of organic remains, and stretch the name of species as far as it will go; the other give specific value to minute differences of size and form, which, in a larger series of specimens, either recent or fossil, would be found valueless in classification. In this work Dr. Leidy has joined himself to the latter class, and has marked every small variation by a specific, and, in some cases, even a generic name, and by so doing has added, without any necessity, to the heavy burden of synonyms which scientific literature has to put up with. He believes that the American is a "peculiar fauna," and, that even if no difference between European and American fossils can be detected, their geographical separation is evidence that they belong to different species. For example, in the description of a new species, *Equus excelsus*, he admits that "it is not improbable that part of the specimens looked upon as fossils may be the remains of the Mustang, or recent wild horse of our western wilderness." Nevertheless, he holds to his own undefined specific name. This fault is carried to an extreme, in the case of the extinct family Anchitheriidæ. On the small foundation of one tooth, which, "in general proportions and construction," and "in size," is "nearly the same as the teeth of *Anchitherium Aurelianense*," a new genus, Anchippus, is based; while four milk molars, which "in form, mode of insertion, and general constitution and size, bear a near resemblance to those of the same species," constitute the basis of the second new genus Parahippus. This mode of treatment runs more or less throughout the work, and renders it of less value than might have been expected from the importance of the subject-matter. But, nevertheless, it is a mine of information to which Tertiary naturalists will resort for many long years to come.

I will now pass on to the consideration of the leading features of the Miocene fauna. On the borders of the ancient Miocene lake, from which the Mauvaises Terres

were deposited, lived a most remarkable group of herbivores, all of which were, roughly speaking, less specialised than any now on the face of the earth. The Oreodon, a ruminant about the size of a large domestic sheep, was there in considerable abundance, and must have lived in herds, after the manner of the bison in the neighbouring region. It was an animal of a strangely composite kind; to the molar teeth of a ruminant it added the ulna and radius of a hog; it possessed a cranial and temporal region like that of the camel, and larmiers beneath the orbit as in the Cervidæ and the musk-sheep. Its canines were trilateral and worn like those of a pig, and its dental armature was complete all round. Three closely-allied forms, the Merychochœrus, Leptauchenia, and Agriochœrus, are associated with Oreodon, and form a group which, judged by existing forms of life, stands half-way between the pigs and the ruminants. It is an admirable instance of one of Prof. Huxley's "intercalary types." The camel or lama was represented by two allied forms, the Pœbrothere and Protomeryx, and the musk-deer by the Leptomeryx. The Artiodactyle division was present in very strong force. The Elotherium is allied to the hog, peccary, and hippopotamus. In a full complement of teeth it possessed a canine almost carnivorous in character. It was probably less omnivorous than any of the class now living. The Perchœrus, Leptochœrus, and Nanohyus, form members of the same class, together with the Hyopotamus and the Titanothere, which was possessed of a well-developed and separate ulna and radius. The remains of rhinoceros indicate one, and perhaps two forms, during the American Miocenes. The lowness of the crowns of their teeth, the large development of the incisors, and the absence of any trace of horn-basis on the skulls which have been preserved, imply that they belong to the hornless section Aceratherium, of Dr. Kaup, rather than to the true rhinoceros. Dr. Leidy has very rightly separated Hyracodon from the true rhinoceros, because it has the full complement of teeth in both jaws. The Anchithere represented the horse in this fauna; the Palœolagus the hare; and there were also squirrels, beavers, mice, and hedgehogs present.

There was also a corresponding development of the Carnivora. Two species of Amphicyon performed the function of the living foxes and wolves; the Hyænodon that of the hyæna; while the great Machairodus, and the allied form Dinictis, represented the lions, tigers, and other larger felines.

If this fauna be compared with that of the European Miocenes, several important differences and resemblances may be remarked. The whole group of antelopes, found in such numbers in the classic plains of Pikermi by M. Gaudré, and in central France, are absent. The giraffe also, and the family of the Cervidæ, and the horse, elephant, Mastodon and Hipparion of Europe, are equally absent. Other genera are common to both Europe and America. The *Elotherium Moretoni* of the Mauvaises Terres can scarcely be distinguished from the *E. Aymardi* of the Gironde. The *Anchitherium Bairdi* cannot be distinguished with certainty from the *A. Aurelianense* of France. The rhinoceros and Aceratherium of Eppelsheim and Pikermi find their analogues in the so-called *Rhinoceros occidentalis* and *R. meridianus* of America, while the Hyracodon recalls forcibly to mind the small rhinoceros from Sansan (*Aceratherium Sansanense*). The Lophiodon is also an American form. Of the Carnivores, the *Amphicyon vetus* is the equivalent of the *A. major* of De Blainville from Sansan, while the Hyænodon and the sabre-toothed Machairodus were the scourge of the Miocene herbivores in America as in Europe. The family of the Oreodontidæ, on the other hand, seem peculiar to America, as also the Titanothere and the small carnivore the Dinictis.

This distribution of life throws considerable light on the physical geography of the northern hemisphere during the Miocene period. The absence of the South American forms which were living at the time, the apes, the rodents, and the edentata, implies the presence of a barrier between North and South America, which prevented migration from the one to the other; and this barrier was most probably, as Prof. Huxley remarked in his last address to the Geological Society, an open sea. The forms of life common to Europe and North America imply a continuity of land between those now widely dissociated areas. Mr. Murray believes in the existence of a Miocene Atlantis, which has left the Sarghasso sea as a palpable monument of its existence in the mid-ocean. I should, however, be rather inclined to look for the continuity of land in the direction of Siberia, Behring's Straits, and, it may be, Greenland; and when the recent wonderful discoveries of temperate and sub-tropical vegetation in the now Arctic regions is taken into account, it appears to me extremely probable that the animals migrated from one area to the other by that pathway. But whether this be accepted or not, Prof. Heer has shown that during the Miocene times there was a vast extent of land, and a temperate climate in the now extremely high northern latitudes, which would imply conditions of life favourable for the migration of the Miocene animals. It is impossible to find out with any certainty the direction which the Miocene migration took, whether from America towards Europe and Asia, or *vice versa*. There is, however, one very significant fact to be observed, that the American Miocene fauna is less specialised than the European, or, in other words, that it is of an older type. It contains no true hyænas, nor deer, nor antelopes, nor any of the living genera which first appeared in the Miocenes of Europe. Possibly in point of time, or rather in homotaxy, it was older and more closely allied to the Eocene. The explanation which strongly suggests itself to my mind is that the migration set in from the old world, and that the above-named living genera sprang into being here, and are not found in the American Miocenes, because they had not time to reach that area. Thus the absence of certain extinct genera, such as mastodon and hipparion, may be accounted for. That eventually they found their way thither will be seen in the succeeding part of this essay relating to the Pliocene.

W. Boyd Dawkins

## *NAUMANN ON THERMO-CHEMISTRY*

*Grundriss der Thermochemie.* By S. Alex. Naumann. 8vo. pp. viii. and 150; price 3*s*. (Brunswick, 1869. London: Williams and Norgate.)

IT is not altogether without reason that modern chemists are accustomed to point, as a proof of their activity, to the amount of materials they have succeeded in accumulating. The fact, indeed, is sufficiently familiar to most students.

If any one will examine a popular chemical manual, he will find its pages occupied almost wholly with experimental results, connected by an imperfect and partial classification. Should he feel envious to know what laws have been acquired by the science, or how far it at present possesses a deductive form, the whole of the information he seeks is generally proffered in a few paragraphs. Nor can it be denied that, as a rule, the manuals have given a fair representation of the kind of chemistry that we are compelled to use for the purposes of teaching. But not only has this state of things been repeatedly predicted; the result has also been discerned. The most distinguished chemists have from time to time seen the fundamental identity that exists between their own science and that of physics, and have recommended the conjoint study of these subjects as likely to prove of the greatest advantage to each, until the apparent and illusive difference between them shall have vanished, and their separate efforts be blended in a single enterprise. In recent times, the special character formerly assigned to chemistry is advocated only by the few who are content with the prevailing style of research. Every one will, therefore appreciate the eager interest that has always been shown in any attempt to construct a firm and logical union between chemistry and physics. Such an union is now being accomplished by the science of Thermo-chemistry.

If we look back to the beginning of this century, we shall see how little reason we had to expect that the desired result would be brought about in such a manner. At that time, there were but few who did not regard heat as, in some way or other, a kind of matter, and not many who deemed its study of much importance. Lavoisier, it is true, touched the obscure topic with his restless fingers; but while we cannot withhold our respect from the inventor of the calorimeter, few will excuse the great opponent of phlogiston for his theory of caloric. Thénard, on the other hand, was the first to show, in his classification of the metals, the great importance to chemistry of the study of temperature. His principles and the fruit of his teaching can easily be traced in modern chemistry. But it was not in the study of pure thermotics that thermo-chemistry took its rise. That science could not furnish, what the weakness of the mind invariably demands, a conception on which to proceed. Heat might be a mode of motion. But motion of *what?* The passage in which Rumford announced his discovery is sublime in its simplicity and unsullied by any materialistic taint. The popular prejudice stripped that magnificent idea of its regal investiture, and clothed it in the garments of a corpuscular theory. Dalton's atomic doctrine, at first received with coldness, has long been almost universally accepted among chemists; but it is only, perhaps, within the last decennium (for Mayer and Joule must be omitted) that a few prominent physicists, among whom Naumann himself is to be enumerated, have given in their adhesion to Dalton's fundamental views, and constructed for themselves a new basis on which to work. Thus, then, has arisen the science of thermo-chemistry; and it is not, consequently, very surprising that it should teach us that heat is a kind of undulatory movement (*Bewegungsform*) of molecules or atoms. On the whole, we are inclined to regard the atomic constituent of the infant science as "accidental" (to borrow a term from mineralogy); in anything equal to a calculus, it will prove to be an intolerable hindrance to perspicuity, infecting the purely inductive part with a host of extraneous entanglements.

Professor Naumann is far too acute and experienced a reasoner not to perceive that it is precisely at this point that objections are most likely to be made. Accordingly he is careful to fortify his position by a well-digested chapter on the atomic theory, in which the usual arguments are advanced with much more than the usual thought and distinctness. It may aid the reader to form a judgment of how far his author has succeeded, if we notice one or two points in the discussion. Almost at the outset, we are warned that demands on the accuracy of a scientific theorist must not be severe or stern. "The essential value of a theory does not consist so much in its fundamental hypotheses, but in the connecting of known facts and enabling us to discover new relations." Further on there is sufficient confusion in the terms employed to mislead one into supposing that an element enters into combination with unaltered properties; whereas, of course, it must always gain or lose by that process. The existence of bodies having the same per-centage composition, but different reactions, is adduced to prove that the matter in them must be divided into discrete parts in each case. Does it not rather prove that matter has nothing whatever to do with chemical properties? Again, the passage beginning "If we now suppose the process of mechanical division to be carried on continuously, a limit must at length appear," &c., is as clear a case of *petitio principii* as we remember to have met with.

The work of Professor Naumann is intended as a sort of summary, in a form specially designed for the student, of what the science of thermo-chemistry has been able to achieve. The accomplished author, who has taken a most important practical share in the results he describes, has spared no pains to perfect his labour with such an end in view. We need hardly say that an effort, in itself so desirable and meritorious, is in its result both opportune and intelligible. We may as well, perhaps, point out that the chapters on Dissociation and kindred subjects have received, as was natural, the greatest amount of development.

The progress of biology has repeatedly been opposed by an obstacle which, under the name of "mind," it has scarcely known how to treat, but with respect to which it is just beginning to find its true position. In like manner, physical science, and chemistry particularly, has had to encounter a phenomenon which, under the name of "matter," has continually impressed upon it the heaviest and most severe of theoretical burdens. It will be strange, indeed, if biology should steal a march on physics.

E. J. MILLS

## OUR BOOK SHELF

*The Interior of the Earth.* By H. P. Malet, F.L.C.S. 8vo, pp. 175. (London: Hodder and Stoughton, 1870.)

THIS is a very good example of a book which ought never to have been written. The author tells us in the introduction that, in approaching the most complicated problem of the condition of the interior of the earth, he has "culled from contemporary literature such extracts as fit" his

subject, and that "his intention is to offer a new interpretation of observed phenomena." The "contemporary literature" which has afforded the materials for the "new interpretation" consists of Page's "Geological Manual," Phillip's "Vesuvius," and very many extracts from the current weekly and quarterly periodicals for the last year. With the exception of an allusion to M. Daubrée, obtained from an appendix to Professor Haughton's "Manual of Geology," the author shows no acquaintance with any of the French or German authorities who have worked so hard at his subject. He is, moreover, in ignorance of the labours of Sorby, and of the translation of Bischoff, published by the Cavendish Society. Had he read Lyell's "Principles" he would certainly not have been betrayed into writing such a strange book as the "Interior of the Earth."

We will give one sample of the quality of "the new interpretation." "Page tells us 'that the interstratified trap-tuffs, the basaltic outbursts, and the numerous faults and fissures testify to a period of intense igneous activity.' *We have a familiar example of this action in our hot-beds and our hay-ricks.*" Mr. Malet then proceeds to explain the earth's heat and volcanic phenomena by a like action on buried vegetable matter. To combat views such as these would be absurd. Their author has succeeded in gaining a place among geologists similar to that of the circle-squarer among mathematicians. Z.

*Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden.* (Jahrgang, 1869. Nos. 10—12.)

THIS part of the report of the Isis Natural History Society of Dresden contains as usual a great number of interesting notices in all departments of natural history, the most important being on botanical subjects, namely, the commencement of a prodromus of the Lichens of Saxony, Thuringia, and Northern Bohemia, by Dr. L. Rabenherst, and the conclusion of a synopsis of the Coniferæ, by M. Laessig. In the latter, diagnoses of the families and genera are given, and the general characters and geographical distribution of the species are indicated. In the continuation of a lecture on extinct mammalia, Dr. Günther noticed the following species:—*Canis familiaris fossilis*, *C. spelæus* (=*C. lupus*), *C. vulpes fossilis*, *Hyæna spelæa*, *Felis spelæa*, *F. antiqua*, Cuv., *F. minuta fossilis*, Wagn., *F. aphanista*, and *ogygia*, Kaup, and some species of *Mustela*. In a paper on recent explorations for rock-salt in Prussia, M. Otto noticed the occurrence of a vast bed of that mineral near Sperenberg, where a boring has been carried down 2,270 feet, of which 1,920 feet is through a salt bed. The boring has probably nearly reached the bottom of the deposit, as the material brought up now contains much anhydrite. Near Segeberg, in Holstein, a deposit of salt has been met with at a depth of 400 feet.

*Milne-Edwards. Leçons sur la Physiologie et l'Anatomie comparée.* Tome ix. 2me partie. (Paris: Masson et fils.)

WE gladly welcome another instalment of the long and great work, the "beautiful legacy," as Bernard has called it, of the venerable French naturalist. At a time when the "differentiation" of study is carried to such an extent that many physiologists know very little about other animals than frogs, rabbits, dogs, and men, and many zoologists have a very meagre acquaintance with the results of experimental physiology, such a work as this, which skilfully weaves together all the main facts of animal biology, is most wholesome reading. The present part continues the discussion of the Reproductive Organs of the Invertebrata, and contains two lectures on the Development of the Embryo. We trust the distinguished author may be spared still to preside over and finally to witness the conclusion of this great work.

M. F.

## LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

### The Apparent Size of the Moon

DR. INGLEBY is curious to know what Prof. Helmholtz would say on this vexed question. If Dr. Ingleby will turn to page 630 of the "Physiologische Optik," he will find that Prof. Helmholtz has anticipated his wishes. As others of your readers may be interested in seeing how the matter is treated by one who is *facile princeps* in this department, I subjoin a translation of the passage. If the curious experiment mentioned by Dr. Ingleby had referred only to the vertical diameter of the disc, it would have seemed to be another illustration of our inveterate tendency to ascribe an exaggerated value to vertical lines or angles, at or near the horizon. It is said that if ten men be required to fix off-hand on a star half way between the zenith and horizon, nine, at least, will choose one very much too low. If an exact square be cut out in paper and pinned against the wall opposite to the eye, the sides will appear longer than the top or bottom. If an equilateral triangle be placed in the same position, the angles at the base will appear larger than the angle at the vertex. If a line be drawn parallel to the bottom of a sheet of paper, and a second line, making with it an angle of 20° or 30°, any one attempting, without moving the paper, to draw a third line through the point of intersection, so as to make an angle with the second line equal to that which the second makes with the first, will make the second angle too large. (This experiment is guaranteed by Helmholtz.) After reading Helmholtz's theory, metaphysicians may be willing to allow that all these illusions are to be derived, after his example, from the clouds. As metaphysicians have, before now, contributed a good deal to the clouds, it is perhaps only fair that the clouds should contribute something to the metaphysicians.

W. T. RADFORD

"To this category also belongs the celebrated question why the moon appears larger when she is near the horizon than when she is high in the heavens, although, in point of fact, owing to atmospheric refraction, her vertical diameter ought in the former case to seem less than in the latter. Even Ptolemy and the Arabian astronomers were perfectly aware that the true reason why the moon appears larger when seen in the horizon, is that she then appears further off. The real question therefore is, why the sky should appear further from us at the horizon than it does at the zenith. Various causes have been assigned for this fact, and I am myself disposed to admit that there are several causes which combine to produce this effect, so that it may be difficult to say which of these causes predominates in any one case.

"First of all we must remember that there is no decisive reason why the starry firmament should appear to us to be a spherical surface. It certainly reveals to us objects (the stars) which are at an infinite distance; but hence we can only infer that it may assume the appearance of any such indeterminate surface as any motive whatever may lead us to ascribe to it. If we were floating in empty space, and could survey it in its whole extent at the same moment and in all directions, or if its movements were so rapid as to make a distinct impression on the senses, there might be more reason for assigning to it a spherical rather than any other kind of surface. In point of fact, however, its apparent form and apparent direction are constantly changing, according as the portion we happen to see is more or less enclosed by various terrestrial objects, and according as we fix our attention on a higher or a lower spot. We shall see further on that we are naturally disposed to regard it as a plane surface, at right angles to the line of sight, whenever both eyes are steadily fixed on one point.

"But with the canopy of cloud the case is entirely different. The clouds in general are so far from us that the criteria for judging of distance which binocular vision or the movement of our own bodies can supply are utterly useless. But the clouds are often disposed in parallel lines, they generally drift with a constant velocity and in the same direction; when near the horizon they appear like bars across the sky seen edgewise, and so lighted that it is easy to perceive they are bodies whose horizontal extension is foreshortened by perspective. All these indications serve to give us the impression that the true form of the canopy of cloud, at least in the zenith, is that of a very flat

dome. On the horizon indeed these indications cease to serve us; there the clouds, like the mountains, appear to be evenly painted on a vertical or nearly vertical background, which gradually passes into the surface of the earth below, and into the firmament above. Now, since the senses supply no criteria by which we distinguish between the distance of the clouds and that of the sky, it seems only natural that we should ascribe to the one the ascertained form of the other, so far, at least, as we can separate them. This, I believe, is the way in which our conception of the sky, as a flat domelike vault, must originate, vague, variable, indefinite as that conception undoubtedly is.

"Moreover, the apparent increase in the size of the sun or the moon is never very striking or decided, except at those times when the air near the horizon is heavily charged with vapour, and when, as a necessary consequence, the heavenly bodies in question only shine with a very feeble light; we have then the very same effect with which we are perfectly familiar in the case of distant mountains. They appear more distant than they do when the air is clear, and therefore larger. Moreover, when suitable terrestrial objects happen to be placed near the horizon, they add very much to the effect. When, for instance, the moon sets near a tree some twenty feet in diameter, and about 1,000 yards off, as she subtends the same visual angle, and is known to be far more distant, she appears to be very much larger; whereas, when the moon sets behind a flat horizon, there is no object of comparison to enable us to perceive that her small *apparent* may represent a very great *absolute* magnitude.

"When I look at the moon reflected from a piece of parallel glass, so that her image appears to be very near the horizon, I do not find that the image looks decidedly larger than the moon herself seen directly high in the sky, although in this way it is easy to compare the apparent magnitude of the reflected image with that of the terrestrial objects seen together with it. In this case it is evident the reflected image has not the effect of being seen through the vaporous portion of the atmosphere.

"To my eye, the apparent increase in magnitude near the horizon is much more apparent in the case of the moon than in that of the sun. When the form of the sun can be distinguished at all, his light is generally so dazzling that we cannot look at him steadily, and consequently cannot compare him directly with any terrestrial objects that happen to be on the horizon. Even in the case of the moon when the sky is quite clear, the delusion is not so apparent. In all cases the delusion depends in a very great degree on the state of the atmosphere."

## Occurrence of the Little Egret

AN adult specimen of the Little Egret (*Ardea garzetta*, Linn.) was shot at the end of last month, on the mud-flats below Topsham, a town on the Exe, four miles below Exeter, and has unfortunately fallen into private hands. This is the first known occurrence of this beautiful bird on the Exe, but two or three specimens were recorded from the Dart and Tamar more than fifty years ago. The last specimen obtained in South Devon was killed in April 1851.

A nearly adult male Montagu's Harrier was shot near Christon, Devon, last month, and I have obtained it for the collection in this Institution. The female bird has since been seen.

W. S. M. D'URBAN

Devon and Exeter Albert Memorial Museum,
Queen Street, Exeter, June 13

## Pinkish Colour of the Sun

IN addition to the several accounts of the curious pinkish appearance of the sun, noticed in the numbers for May 26 and June 2 of your journal, it may perhaps interest your correspondents and the readers of NATURE to know that the sun presented a round disc of a very unusual pinkish colour, here and at Cranbrook (about five miles north-east from Hawkhurst), in Kent, between five and six o'clock P.M. on the afternoon of Monday, the 23rd ult. It was so seen by myself at Cranbrook, in company with several others, who thought that the colour was quite unusual, shining through a thick haze of apparently low cirrostratus, but which was perhaps rain cloud, as the air at the time was light from the north, and cold, while the mist, or haze, seemed to be at no very great elevation above the ground, and considerably lower than those ordinary forms of cirrostratus in which halos and mock-suns are generally seen.

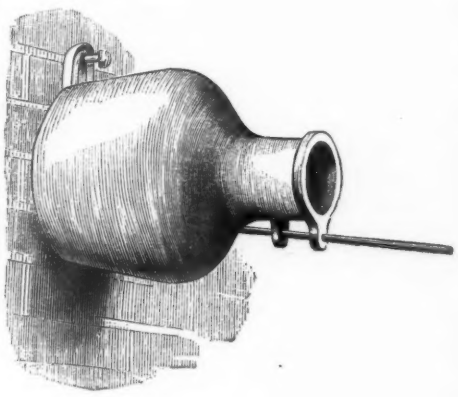
The colour observed here was a pinkish buff, or such a mixture of pink and yellow as to suggest the abundance of more blue and violet, and the absence of more yellow light than in the orange and reddish tints, generally seen in the setting sun, so as to resemble the colour of very pale blotting-paper, or a light flesh-colour. While the disc was still clearly seen of this colour, two or three sun-spots were visible upon it with the naked eye. These could no longer be distinguished at six o'clock, when the peculiar pinkish hue was also succeeded by the ordinary yellow of the sun's disc near the horizon, seen through a thick haze. On the same afternoon (of the 23rd) the appearance of the sun's round disc through a thick cloud of haze in the sky was noticed, for a considerable time, as visible with rare and unusual distinctness at Tunbridge Wells, in Kent.

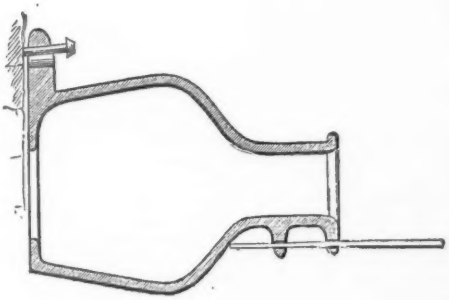
A. S. HERSCHEL

Collingwood, Hawkhurst, June 8

## La Petite Culture en Belgique

I ENCLOSE drawings of earthern pots, which I observed nailed against the south side of a farm-house near this. These pots are for sparrows' nests, and the young, when fledged, are taken





and eaten. I think this form of "La petite culture" cannot be commended in a country so swarming with insects as Belgium, and I infer from the careful make of the pots that the custom is not a new one, though it may be new to some of the readers of NATURE.

N. A. STAPLES

Louvain, June 4

### The Report of the Meeting of the British Association for the Advancement of Science

It would be a great boon to the English public if the papers which are read before the members of the Association, or rather those who have the means as well as the inclination to attend such important annual gatherings, could be published within the first few weeks immediately after the meeting, and at such a price as many in this land would by no means grudge. According to the present arrangement, some months have to pass before even such as can afford the heavy price placed upon these reports can obtain them, the result of which is, that the poor and meagre reports of the various newspapers are all that the majority of persons have to inform them about the advancement of science. Could not some such report as that authorised by the committee of the Church Congress be produced? The first Congress was reported fully, the papers entire, and the discussions almost so, in a well-printed volume of nearly 500 pages, for the moderate sum of half-a-crown, prepaid; or four shillings if purchased afterwards. There are many, I am convinced, who would gladly prepay three or even four half-crowns for the report of the papers only which are read before the British Association.

Birkenhead G. H. H.

## *TERRESTRIAL MAGNETISM*

THE great progress made during the last few years in our knowledge of the phenomena of terrestrial magnetism has naturally attracted not a little attention to this interesting subject, and the persevering efforts of many leading scientific men are the surest guarantee of the ultimate success of the labours undertaken in this cause. Hitherto theory has gone hand in hand with observation, and those most able to undertake the charge are now only waiting a more complete array of facts, in order to present us with a theory of terrestrial magnetism based on solid foundations, and equal in interest, in completeness, and in the utility of its practical applications, to any of its sister sciences. The required facts may be ranged under these two heads. First the actual values of the magnetic elements at all parts of the earth's surface, with the secular variations of these elements; and secondly, the daily, monthly, and yearly range through which these quantities vary, and the irregular perturbations to which they are subject. To meet the first demand, a complete set of magnetic observations must be taken in different countries, the stations of observation not being too far distant from each other; and a repetition of these at intervals of from ten to twenty years will supply an accurate record of the secular variations of the required elements. The second need can only be satisfactorily provided for by the establishment of permanent magnetic observatories, supplied with self-registering magnetographs, by which every change of the magnetic force can be correctly traced.

Fortunately much has already been effected, and more is actually being carried out for the furtherance of this latter object. This country alone possesses three such observatories, Lisbon another, Florence a fifth, and four others are at present in course of erection, at St. Petersburg, Bombay, Melbourne, and the Mauritius. The fact, now clearly established, that any disturbance of the magnetic needle traced by our magnetographs in England has a corresponding perturbation recorded at Lisbon and at Florence, is an earnest of what we may expect from a careful comparison of magnetograms from all quarters of the globe.

But the other branch of observation, on which the determination of the absolute values of the magnetic elements solely depends, has scarce kept pace with the giant strides of the fixed observatories. Doubtless a series of monthly absolute readings is being taken at each magnetic observatory to serve as a basis for the differential curves traced by the magnetographs; but such observatories will always be few in number, and the accurate determination of the magnetic elements of these few points, however useful it may be, will scarcely suffice to give us a complete knowledge of the magnetic condition of the earth's surface. The survey of the ocean we may well trust to the devoted and persevering enterprise of the naval officers, who are adding so much to our store of meteorological and magnetic knowledge; but for the land surveys we must mainly depend on the accurate observations of private observers. A very limited number of scattered observations made at stations remote from each other, and the careful survey of scarcely half a dozen countries of Europe, is all we can point to as at present accomplished. If it be true that labour and expense are the great obstacles to be overcome when an important enterprise has to be undertaken, we may well wonder that the more laborious and by far the most expensive of the observations needed for the science of terrestrial magnetism are being amply supplied by the establishment of fixed observatories, whilst the magnetic surveys, which may be now made an agreeable pastime, and need scarcely add perceptibly to our usual expenses, are nearly entirely neglected. Most men who are daily engaged in intellectual occupations, require yearly a few weeks of repose, or at least of mitigated application. For many, some interesting work that does not too much engross their minds, and that differs considerably from their usual routine duties, offers a means of relaxation far more enticing than a complete cessation from labour. For men of this class, who have had some little experience in the use of instruments of precision, a magnetic survey might offer the greatest attraction during a summer vacation. A brief sketch of a simple method of carrying this into effect, which has been found to work well during two successive vacations, may not therefore be without its utility and interest.

The country chosen for a rapid survey should be one that offers considerable facilities for railway communication; and a previous study of the direction of the lines will prevent much unnecessary expense and loss of time from travelling twice over the same ground. Should the railway arrangements of the country resemble those of France, a companion for the journey becomes an absolute necessity; for the instruments used are of too delicate a make to be entrusted to the tender mercies of foreign railway officials of the registered baggage department.

The instruments required for the survey are a dip circle, an unifilar, a small transit theodolite, and a good chronometer. Two tripod stands are nearly a necessity if time be any consideration. Three days might conveniently be allotted to each station; one for travelling, another for the observations, and the third for visiting the objects of interest in the vicinity. Twenty sets of observations would thus be completed in the course of two months; and two vacations so employed would furnish data sufficient for the accurate study of the magnetic condition of an extensive tract of country. But should the time at the observer's disposal be more limited, and he feel equal to the task, the day of travelling might reckon as a day of rest, and the public monuments be visited during the leisure hours of the day of observation.

Arrived at a station, the first thought should be about the choice of a fit place of observation. The garden of any large public institution will perhaps in general be found the most convenient and accessible, unless an extensive and somewhat retired garden be attached to the hotel. Inquiry must next be made about the position of any considerable mass of iron, such as large pipes, which serve not unfrequently to convey gas or water at a few feet below the surface of a gravel walk or a grass plot. For the observation of the dip and the intensity, a good shady spot is required; whilst, for the declination, a position well exposed to the sun, at the early hours of the morning, is the best possible. A tent may sometimes be required to supply the want of trees; but when a large canvas

covering, with poles, &c., has been carried from the north of England to the Pyrenees without ever being asked to do service, one is more inclined to trust in future to the resources of any locality, rather than again to travel in company with such a burdensome luxury.

Provided the morning be not hopelessly cloudy, it will generally be found preferable to start work by observing the declination. This choice may at times save the travellers a day or more of precious time in changeable weather; for the sun then not unfrequently shows himself for a short time in the early morning hours, and when the clouds have been permitted to close around him, he remains persistently hidden for the remainder of the day. For finding the magnetic declination, the sun is our most useful helpmate; but during the rest of the observations his presence can with benefit be dispensed with. The unifilar is therefore at once put together, and whilst the torsion of the silk thread by which the declination magnet is about to be suspended is being removed, the theodolite is fixed on a tripod stand, and several transits of the sun are taken over the vertical wires. The azimuth circle having been read at each passage of the sun, the telescope is placed horizontal, and the position of a fixed mark determined. A few altitudes of the sun might then be taken, for finding the error of the chronometer, before removing the theodolite from the tripod stand to make way for the unifilar. Great care must of course be taken in levelling each instrument before commencing an observation; and, after railway travelling, all the screws should be well examined. The tripod stand remaining firmly fixed in its first position, the unifilar is placed upon it, and the telescope is directed to the fixed mark and its azimuth read. The magnet is then suspended, brought to rest, and the positions of the azimuth circle and of the magnet scale noted. A second reading of the scale is afterwards taken in the inverted position, and this invertion should be twice performed, for greater security. A glance at his note-book will at once tell the observer whether he has entered all the data necessary for the future calculation of the declination. The chronometer gives the azimuth of the sun for a known latitude and longitude, the sun fixes the chosen mark, and the angle between the magnet and the mark then tells us what are the bearings of the compass at the station of observation. Having thus secured the declination, an interesting set of scale readings may be taken whilst the magnet still remains suspended. These readings, if taken every five minutes during any considerable time, will furnish materials for a comparison with the magnetograms of the fixed observatories; and thus afford satisfactory data for determining the relation that exists between the magnetic perturbations at different points of the earth's surface.

The dip circle is the next instrument to which attention must be directed. The observation of the dip of the magnetic needle is in theory the simplest, and in practice the most trying work of the survey. To attempt it when the atmosphere is saturated with moisture may be an excellent exercise of patience, but can scarcely lead to any trustworthy results; and a dusty locality will easily give the observer hours of labour before he has finished with a single needle. At each station, two or three needles should be used; each observation being the mean of 32 readings taken in different positions of the instrument and needle. The method of observation can offer no difficulties; after levelling the instrument, the needle is magnetised and gently lowered until it rests on its agate planes. The dip circle is then turned round till the needle takes up a vertical position; the reading of the azimuth circle at this point, when increased by 90 degrees, gives the direction of the magnetic meridian. The instrument may now be clamped with the needle in the meridian, and the readings of the angle of inclination commenced. Whilst the dip is being found, the torsion may be removed from the silk thread that serves to suspend the vibration magnet.

A complete knowledge of the direction of the earth's magnetic force at the station of observation having been acquired, it remains to determine the intensity of this force. Knowing the direction, it suffices to measure the intensity of the force in any given direction, in order to ascertain the total effect of the force. The horizontal component of the intensity is then the only element that still remains to be observed, and this is found by the method of vibrations and deflections. A magnet in the form of a small telescope, having a delicately graduated scale at the end farthest from the observer, is hung by a thread, and made to vibrate through an arc of a few seconds. The time occupied by 100 such vibrations is noted by the chronometer to within the twentieth of a second, and this is repeated some twelve times to obtain an accurate measure of the time of one vibration. The square of this interval of time serves to determine the product of the horizontal component of the earth's magnetism, by the magnetic moment of the vibrating magnet.

The quotient of these same quantities is next ascertained from the deflecting power of the vibration magnet. For this purpose another magnet is suspended by a very delicate silk thread, from which the torsion has been removed, and the vibration magnet is placed on a graduated brass bar at known distances from the suspended magnet. The opposite poles of the deflecting magnet are then presented alternately to the centre of the free magnet, and at the same distance due east and west. The various readings of the azimuth circle, and of the scale reflected by the mirror of the deflected magnet, are noted for each position, and the changes of temperature, which enter into the results, are frequently recorded.

The series of observations is then completed, and, when the instruments have again been packed with all possible care, the observers are ready for the journey of the morrow. Very much of the success of the survey depends on the steady rate of the chronometer; and hence no pains should be spared to preserve it from all jolting movements whilst travelling, and altitudes of the sun should never be omitted. But it is, above all, advisable to lose no opportunity of comparing the chronometer at any good observatory that can conveniently be visited on the way.

A full set of the above observations may be taken by one person within the space of half a dozen hours, but then all must have gone on smoothly from starting to the end. A loud clock, a clear-toned bell, or even the rustling of the leaves in a high wind, will not unfrequently compel an observer to recommence his series of vibrations. Or again, the breaking clouds will entice him out with his theodolite, and then the sun will always seem purposely to hide himself at the moment he approaches the fatal wire. But the near approach of friends is what tries most the powers of endurance. The second has arrived for taking the observation, the eye and ear are all attention, and a person shows his interest in the work by spoiling all with an ill-timed question. Or again, the suspended magnet is just coming to rest after a tedious oscillation, the observer's patience is about to be rewarded by a perfect reading, when a violent movement of the magnet makes him aware that the bunch of keys or pocket-knife of a friend, who approaches with the most scupulous avoidance of all noise, have attracted the attention of the giddy little needle. But a good observer will never be overcome by such trifling difficulties.

A two months' vacation passed in this alternation of travel, observation, and repose, will witness the accumulation of data sufficient for the calculation of the isogonics, isoclinals, and isodynamics of a large extent of country, and the observer will return to his routine labours invigorated in mind and body, and with the consoling thought that he has added some little at least to that mass of well-established facts, which must ever be the only foundation of any true advancement in the Natural Sciences.

S. J. PERRY.

## COFFEE

CONSIDERING the fact that the necessities of our daily life, whether as clothing, food, or medicine, are mostly provided by the vegetable kingdom, it is remarkable how little is generally known of the sources from whence we derive our most common articles of commerce. We propose in this article to say something about our Coffee, and especially about the mode of detecting whether the commercial article is pure or adulterated.

Although the specific name of the coffee plant, *Coffea Arabica*, appears to indicate the coffee tree to belong originally to Arabia, it is with good reason supposed to be a native of the mountainous part of the south-west point of Abyssinia, having been introduced from thence into Arabia, where it is said to have been first used about 1450. For about 200 years after this date the whole of the coffee used was grown on Arabian soil, from whence the Dutch introduced the plant into Batavia, after which it was carried into other eastern countries as well as into various parts of the western hemisphere. The introduction of coffee into Europe took place about the middle of the sixteenth century, fourteen years before the introduction of tea.



FIG. 1.—Branch of Coffee Plant.

The fruits of the coffee tree when ripe are gathered and taken to the pulping house, and placed in a machine called a pulper, by which the fleshy covering is removed, the beans or seeds pass into a cistern, and the pulps are carried off in another direction and are collected and preserved for manure; the seeds themselves are left to steep for several hours, so as to soak off any remaining mucilage or pulpy matter; they are then washed and dried, the parchment and the thin inner skin being removed by winnowing, after which they are packed in bags and ready for shipping.

The berries or seeds of true Mocha coffee, which is, however, now scarcely to be obtained in Europe, are usually more round than those of other varieties; they nevertheless vary much in form as well as in size and colour; and though the several commercial sorts are easily known to a practised eye, they are difficult to detect by an ordinary observer. The value to the consumer does not in all cases depend so much upon the size or shape of the seed as upon its flavour and the strength of its aroma, but these qualities cannot be discovered until after roasting; therefore in purchasing unroasted coffee, an important point is to see that the seeds are not damaged by sea water or mouldiness. In roasted "whole" coffee, the case is different, for a greater or lesser aroma of more or less fragrance can be detected, the volatile oil, and the peculiar astringent acid to which the aroma and flavour are due, and which before were latent in the seed, being developed



FIG. 2.—Coffee Berry (*nat. size*).



FIG. 3.—Section of Coffee Berry (*magnified*).

by the heat. In the process of roasting, the seeds lose about one-fifth in weight, but increase in bulk by about one-half.

The peculiar principle of coffee is called caffeine, and is identical with that of tea; it acts as a stimulant upon the brain, preventing sleep or drowsiness, and causing greater mental as well as bodily activity; it is also said by some chemists to repair or prevent in a remarkable degree the too rapid waste of the tissues, so that life can be sustained on a smaller quantity of food than would be the case without the use of coffee.

Understanding these principles which Nature has given to coffee, and which Science has revealed for our benefit, we cannot fail to see the great importance of obtaining the article in its genuine state. Upon microscopical examination, genuine coffee can be easily detected, the cells of the coffee-seed being very irregular in form, and having very thick walls with ragged sides. Some of these ragged projections belong to the true cell wall, while a few are composed of starch granules. Genuine coffee, then, should always present this appearance, for there are no tubes or spiral vessels in the true coffee seed as there are in the root of the chicory; and moreover, in the cellular part of the chicory root, the cells themselves are larger, the walls are shown as mere fine lines, closely fitting together by the pressure exerted upon them in the process of growth. This difference will be more readily understood by reference to Figs. 4 and 6. In the most genuine coffee, however, a certain portion of the skin must be present, the microscopical appearance of which is shown at Fig. 5; by reference also to Fig. 3, it will be

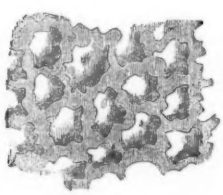


FIG 4.—Tissue of Coffee Seed, after being roasted and boiled.



FIG. 5.—Microscopical appearance of Coffee Skin, after being roasted and boiled.

seen how a portion of this skin is naturally enclosed in the folds of the seed, so that, while in the process of cleaning it is entirely removed from the surface of the seed, the enveloped portion remains, as it cannot be removed without breaking or injuring the seed. This, however, has been done in the trade, and a series of coffees was

exhibited in the Great Exhibition of 1851, amongst which were roasted coffee seeds which had been divided longitudinally by a patented machine, and the folded skin taken out; these broken seeds were sold under the name of coffee nibs. We do not see any advantage in this; but on the contrary, the broken seeds would be much more liable than whole seeds to adulteration with damaged berries, and this skin is so thin that it adds little to the weight of the coffee, and the small proportion in which it occurs does not affect either the pocket or the health of the consumer; indeed, we are told by some travellers, that neither the skin nor the parchment itself deteriorates the quality of the coffee, but rather adds to its value, for in some parts of Arabia the parchment is preferred before the seed itself.

Therefore genuine coffee, when seen under a microscope, will exhibit an appearance similar to that shown at Fig. 4, with the addition, in nearly all cases, of a few small bodies like those at Fig. 5, scattered here and there.

A very simple test for the presence of chicory in ground coffee, is to drop a little in a tumbler of clean cold water. Do not stir it, but if chicory is present the particles will immediately drop to the bottom of the tumbler, imparting at once to the water a deep amber colour; the coffee particles will float for a much longer time, and the water

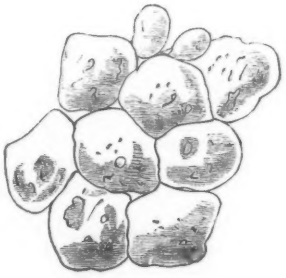


FIG. 6.—Cellular Tissue of Chicory.

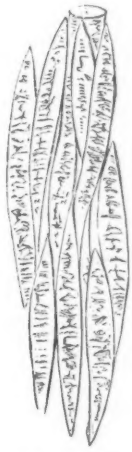


FIG. 7.—Vascular Tissue of Chicory.

will be but slightly coloured. The most satisfactory way of purchasing coffee, however, is in the whole state, and to grind it as it is wanted, when all the freshness of the aroma is obtained in the infusion. For examination under the microscope, coffee should be previously soaked in water, or boiled in a weak solution of potash; this both softens the tissues and makes the substance more transparent. For persons unacquainted with vegetable structure, it will help them very much in determining the microscopical appearance of genuine roasted coffee, to examine first both the fresh coffee seed and the fresh chicory root; for this purpose a slice should be cut from each as thin as possible, moistened with water, and placed on a glass slide with an ordinary thin glass covering dropped on the top, and gently pressed down with the fingers so as to exclude all air bubbles. A half-inch objective may be used, and with an ordinary amount of perception adulterations may be detected. Other substances than chicory may be mixed with coffee, but none will present such microscopical appearances as those we have shown to belong to genuine coffee.

J. R. JACKSON

## NOTES

WELL-WISHERS of the University of Oxford will rejoice to hear that the honorary degree of D.C.L. has been offered to Mr. Darwin. The state of Mr. Darwin's health unfortunately precludes him from accepting the proffered honour, but the scientific naturalists of this and other countries will none the less appreciate the compliment which has been paid to their great leader. It is all the more graceful as Mr. Darwin is not an Oxford, but a Cambridge man, a circumstance which the University of Cambridge seems to have forgotten; though by-and-by it will be one of her claims not to be herself forgotten.

DR. HOOKER, F.R.S., and Professor W. H. Flower, F.R.S., have been appointed examiners in botany and anatomy for the Natural Sciences Tripos at Cambridge. The other examiners are Professor Miller, Sec. R.S., in mineralogy, Mr. Trotter, fellow of Trinity College, in chemistry and physics, Mr. Danby, fellow of Downing College, in geology.

WE are glad to announce that Mr. Geikie has arrived in England, and is in a fair way of recovery.

THE Sars subscription fund has now reached 343*l.* in England, and 11,666 francs in France. It is very desirable that intending contributors should forward their subscriptions without delay.

IT is reported that the Secretary of State for India has determined upon establishing in this country a complete College of Science for civil engineers, for the education of those who are to be employed on the extensive Government works in that country.

ALL true lovers of science will be glad to hear of the approaching visit to this country of Prof. Henry, the Secretary of the Smithsonian Institution at Washington, United States. It is well known how much our own celebrated electricians are indebted to Prof. Henry for his valuable researches in magnetism and electricity, the results arrived at being freely placed at the disposal of all whom they might interest. We understand he is daily expected.

THE celebrated photographer, M. Niépce de St. Victor, having died in very straitened circumstances, leaving a wife and two children totally unprovided for, a committee of French photographers has been formed to collect a fund for their relief. Subscriptions may be forwarded to MM. Blacque and D'Eichthal, bankers, 19, Rue de Grammont; or to the president of the French Photographic Society, 9, Rue Cadet, Paris.

IN the Rev. William Hincks's address as President of the Canadian Institute, we find the following sentence:—"If we may implicitly believe a statement in the new periodical devoted to natural science, NATURE, whilst the English are still discussing the possibility of Darwinianism being true, the Germans have so thoroughly adopted it that it has become the foundation for new systems—the starting-point for fresh inquiries. This may appear to most of us to be going somewhat too fast; but then NATURE may be presumed to be the special organ of the extreme Darwinians, and might be thought to see facts through a somewhat coloured medium." It will hardly be necessary to point out to our readers that we are the organ of no party, extreme or otherwise. Free play has been given in these pages to the expression of opinion by competent men of every section or party. In so far as "Darwinianism" implies rigid accuracy of observation and a candid consideration of all the varied phenomena of natural science, we trust we shall always be Darwinian as we hope to be Newtonian.

A. H. GARROD was elected on the 13th inst. a Foundation Scholar of St. John's College, Cambridge, for proficiency in the Natural Sciences; at the same time H. Blunt and H. N. Read

were elected, for the same cause, to exhibitions of 20*l.* and 10*l.* respectively. Mr. Garrod obtained in 1868 the Natural Science exhibition of 50*l.* per annum, open to students commencing their residence.

THE committee who organised courses of lectures for women at Cambridge last year have issued the following scheme of lectures for the academical year 1870-71. They will be delivered, generally speaking, twice a week within the period of University residence:—English History, by Professor Seeley. English Literature, by W. G. Clark, M.A., and others. It is proposed to give a series of short courses on different departments of English literature. They will be delivered once a week during the October Term, certainly, and, if possible, during the whole academical year, commencing with a course on "Shakespeare and the Elizabethan Dramatists" by Mr. Clark. English Language and Literature, by W. W. Skeat, M.A.; Latin, by J. E. B. Mayor, M.A., and A. Holmes, M.A. (Elementary Lectures); Greek, by J. Peile, M.A.; German, by W. C. Green, M.A.; French, by M. Boquel; Algebra and the Principles of Arithmetic, by Professor Cayley; Practical Arithmetic, by J. F. Moulton, B.A.; Geometry and Elements of Physics treated Historically, by W. K. Clifford, B.A.; Logic, by J. Venn, M.A.; Political Economy, by A. Marshall, M.A.; Geology, by T. G. Bonney, B.D. (Botany, by Professor Babington, will be substituted for Geology in the Easter Term); Chemistry, by P. T. Main, M.A.; Harmony and Thorough Bass, by G. M. Garrett, Mus. D.; Theory of Sound in its application to Music popularly and experimentally treated, by S. Taylor, M.A. All persons wishing to attend any of these lectures in the next October Term are requested to apply to the Rev. G. F. Browne, St. Catherine's College, on or before the 1st of October. The committee announce the following Exhibitions:—One of 40*l.* per annum for two years, to be given to one of the senior candidates in the Cambridge Local Examinations, January, 1871, according to the report of the examiners. Attendance at two courses of lectures in every Term will be required as a condition of receiving the Exhibition in each year. Given by Mr. Mill and Miss Taylor. One of 20*l.* for one year together with free admission to three courses of lectures in each Term; and one of 10*l.* for one year. Given by Mrs. Adams. These two will be given by two of the candidates in the Cambridge Examination for Women, July, 1870, according to the report of the examiners. Attendance at two courses of lectures during each of two Terms at least will be required as a condition of receiving either of these Exhibitions.

THE following elections to scholarships have been made at Gonville and Caius College, Cambridge: G. Warington, 50*l.*, for chemistry; G. J. Romanes, 20*l.*, for anatomy and physiology. We hope that this College, which has been peculiarly prolific in eminent medical men, will soon follow the example of some of its neighbours in offering open scholarships for Natural Science.

DR. ALBERT WALSH was elected, at a meeting of the Royal College of Surgeons of Ireland, held on the 13th inst., as president of the college for this year, and Dr. Wharton was elected vice-president. The only alteration in the council was the election of Dr. Butcher, by a small majority, in place of Dr. Mapother.

THE examination for the vacant fellowship in Trinity College, Dublin, commenced on the 30th May, and concluded on the 11th inst. The following numbers represent the highest possible answering in each of the three courses. Mathematics, 1,250 (pure 1,000, experimental science 250), classics 750 (classics 650, Hebrew and cognate languages 100), mental and moral science 500. The election took place on Trinity Monday, when George Cathcart was elected fellow and the Madden Prize was given to W. S. Burnside.

THE *Academy*, referring to Mr. Lockyer's recent observations that the various vapour-currents in the solar envelope, which has been called the chromosphere, and defined as possibly the outer layer of the sun's atmosphere, were so rapid and violent that the position of the hydrogen lines in the spectrum was altered, and that by noting the amount of alteration, the actual velocity of these "solar storms," as Mr. Lockyer has termed them, could be determined without difficulty; states that Father Secchi, of Rome, who a long time ago denied the accuracy of these observations, and the validity of these conclusions, has quite recently returned to the charge. Father Secchi asserts that the alterations observed in the wave-length are really due to the *sun's rotation*, and then he proves by calculation that the velocity of the sun's surface at the equator is 429 kilometres per second. He next calculates what alteration this motion should make in the position of the hydrogen lines in the spectrum; and last of all he points his spectroscope to the sun and sees exactly such alterations as his calculations require. Now this at first appears a final answer to Mr. Lockyer, but Volpicelli and Fizeau have pointed out that Father Secchi's calculation in fact shows him to be ignorant of Mr. Lockyer's reasoning, and that his 429 kilometres per second should really read two kilometres.

THE *Gardener's Chronicle* congratulates us on finding that our friends across the Channel have as characteristic a Circumlocution Office as ourselves. Here is what the French papers say on the matter:—A provincial druggist, desirous of gathering Fox-glove (*Digitalis*) in one of the State forests, applied for permission to the local authority (*garde général local*), offering at the same time to pay an annual sum of six francs for the privilege. The local magnate transmitted the request to his inspector, who forwarded it to the Conservator of the department, who despatched it to Paris to the Director-General of Forests, who caused it to be sent to the Minister of Finance. The Minister referred it "for study" to the Director-General of Domains, who sent it to the Departmental Director of Domains to be examined by the Registrar. The latter, after examination, pronounced a favourable opinion on the request, and sent it back to the Departmental Director, who forwarded it to the General Director, who, in his turn, despatched it to the Minister, through the agency of the General Secretary of Finance, who availed himself of the opportunity to make his comments on the matter. Then the unhappy druggist's request was returned to the Director-General of Forests, who sent it to the Conservator, he to the inspector, and the inspector to the *garde général*, who was the original recipient of the request. The authority "to cull simples," at length reached the successor of the original postulant, and at an age when he was too old to herborise. We hope this style of management will not be engrafted on to our Indian forest department, already well provided in this way.

THE lecture next Sunday evening at St. George's Hall, Langham Place, under the auspices of the Sunday Lecture Society, will be delivered by Mr. D. Forbes, F.R.S. The subject is "Volcanoes."

M. CLAUDE BERNARD commenced yesterday in the amphitheatre of the geological gallery his course of lectures on general physiology at the Museum of Natural History, Paris. He will treat of the general principles of physiology, especially from the point of view of its relation to the other sciences.

DR. MAXWELL T. MASTERS is engaged in editing a new edition of "Henfrey's Elementary Course of Botany," condensed, and in many parts re-written, which will be published in a few days.

DR. R. VIRCHOW has contributed to a recent number of the *Zeitschrift für Ethnologie* an interesting article on "Portrait or

Facial Urns" (*Gesichts-urnen*), which has been printed separately. Funereal urns, containing bones and ashes, have long been known, in museums, from Egypt and Etruria, the lids of which, generally of stone, were fashioned into the shape of a human head, or that of some other animal. The human heads, if not portraits, are supposed to have at least indicated the condition of the deceased. In the course of the last forty years facial urns have been discovered in mounds in various parts of Germany, mostly near the Roman settlements on the Rhine, but more recently in the neighbourhood of the watering-place Zoppot in Pomerania, but confined to a very circumscribed district, and exhibiting, according to Dr. Virchow, points of marked difference from those found in Rhenish Prussia. Many of these have well-developed human faces, others have rough drawings of animals, sometimes difficult to make out, scratched upon them. Similar urns are described as having been found in Mexico and Peru; but Dr. Virchow believes that the peculiar contour and form of ornamentation of these North German urns indicate an Etrurian origin, and possibly point to a colonising of the Baltic from Italy.

AT the last meeting of the Scientific Committee of the Horticultural Society, the Rev. M. J. Berkeley exhibited some specimens of the female form of *Lychnis diurna*, in which the flowers were infested with smut, and the stamens, usually abortive, were developed. Mr. Berkeley believes that "the *Ustilago* penetrates the plant, but as it can only fructify in the stamens, it would appear to be the determining cause of the production of those organs in the normally female flower." It is laid down as a rule in Mr. Darwin's works that no change can take place in a species through the agency of Natural Selection unless the change is for the benefit of the species. It is difficult to see how the abnormal production of stamens for the purpose of finding a home for the smut can benefit the *Lychnis;* and it would be interesting to know whether vegetable physiologists generally will sanction the idea of such a power in the plant to develope organs which assist in its own destruction.

WE have received a letter from Mr. Walenn pointing out that in our report of the meeting of the Chemical Society on May 19, we have omitted to mention that the calico-printing roller which was exhibited was immersed for some days in a bath containing sulphuric acid and cupric sulphate, then coated with brass in an alkaline liquid, and finally coated with copper in an acid bath. A deposit, $\frac{5}{16}$ of an inch thick, weighing 29 lbs., and of compact copper, was thus produced.

THE *Chemical News* describes a new method of heating stoneware vessels, and of obtaining regulated high temperatures, which will be of considerable importance in conducting chemical and pharmaceutical operations for manufacturing purposes. By this new method, which has been patented by Mr. J. A. Coffey, the pharmaceutical engineer, any temperature ranging from 100° to 700° F. can be safely and easily obtained. The principle is to cause heavy paraffin oil to circulate, first through a coil of pipes in a furnace, and then through the jackets of the pans. It moves by its own convection. As contrasted with steam-heat, the inventor claims for his process a saving of 30 per cent. in fuel, the large amount of heat necessary to convert water at 212° F. into steam at 212° being economised.

"THE Autotype Process: being a practical manual of instruction in the art of printing in carbon or other permanent pigment," is a handsomely-printed pamphlet of 48 pp., very clearly written, and describing all the modern improvements in the process, which are considerable. It is divided into five parts, which treat of the nature and history of carbon printing, its general practice, its special practice for non-inverted pictures, its special practice for inverted pictures, and concluding observations

## ETHNOLOGY

### The Meenas of Central India

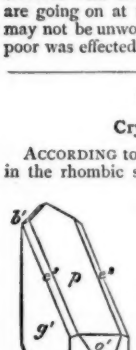
LIEUT-COL. C. L. SHOWERS has communicated to the Proceedings of the Asiatic Society of Bengal, a paper upon the Meenas, a wild tribe of Central India. Lieut.-Col. Showers says, that when the Meenas first fell under his observation in the year 1854, they were in a condition of entire lawlessness. Emboldened by long impunity they carried their audacity so far as to attack and pillage several walled towns in the British district of Ajmur, carrying off not only the entire plunder to their hill fastnesses, but numbers of the inhabitants also, holding them to ransom. At that period it fell to the duty of Lieut.-Col. Showers to take them in hand. He proceeded to Jehazpoor, the centre of the disturbed district, and inaugurated certain measures for the tranquillisation and reclamation of the race. From time immemorial, Jehazpoor, in the State of Adeypoor, had been a notoriously disturbed district. A period of brief tranquillity was accorded to Jehazpoor during the early part of the present century by the appalling severity of the measures of the noted minister Lalim Sing, after Jehazpoor fell into the possession of Kotah in 1806. On the restitution of the district, however, to Meywar, in 1819, it soon relapsed into its former disturbed condition. Jehazpoor was, in truth, a position well chosen for the lawless occupation of professional marauders, being a strong, hilly, and jungly country, where the boundaries of four jurisdictions meet, viz.—Meywar, Boondee, Jeypoor, and Ajmur. There are twelve tribes of Meenas in Central India, but the one under notice is called the Purihars, who were the dominant race in Marwur, till dispossessed of their ancient capital Mundore by the Rhatees towards the close of the fourteenth century. In a generation or two afterwards they are found in the Chronicles lurking on the quadruple boundary already alluded to, a race of outcasts without a common head; and such they have continued ever since, "their hand against every man, and every man's hand against them," plundering in gangs and joining any of the great marauding movements that have from time to time been organised under noted leaders. Thus in 1847, some of the boldest of the outlawed Thakur Javahir Singh's followers were these Meenas. The same indomitable spirit which carried the Purihars forth out of the land of their lost dominion seems to have maintained them in a state of wild independence throughout the long interval since; for though nominally owing allegiance to the States upon the verge of whose territories it has suited their purpose to locate themselves in *fallahs* or gangs, they have never really succumbed to any power, but, hanging together as one man, have always united to repel the frequent futile attempts that have been made from time to time by the rulers of States to coerce any of their Meena subjects, so-called. The aggregate of male adults in the tribe is about 24,000; of this number about 10,000, distributed in 200 villages, are located along these border tracts. Individually the men are brave to desperation, athletic and hardy, many of them tall with fine countenances, denoting their superior origin. The Meena will neither eat, smoke, nor intermarry with the aboriginal Buhl, Mair, Kole, or low-caste Meena of the Aravulla; that is to say, he will not give a daughter in marriage, though he will take to his bed as many daughters of inferior tribes as he can support. Their pride of birth is indeed excessive, fostered by traditions ascending beyond the bounds of history to the regions of myth. The genealogist of the tribe is the honoured guest in every village he visits in his annual round. Each family engages his company for one entire day, which is occupied in recording in the ponderous MS. volume the recent additions to the family tree, whether in the male or female branch; for even the ancestry of the women is duly recorded. About half the tribe are armed with matchlocks of a superior manufacture, about half with the bow, and all with the kattar, or double-hilted dagger, which is a weapon they peculiarly affect. It is a weapon never detached from the person a moment, waking or sleeping. Free from the ordinary prejudices of caste, the Purihars are great eaters of meat, which their cattle-lifting raids furnish in profusion. They are also great drinkers of spirits, which serve to increase their natural ferocity. All are married, and many besides take in keeping the widows of their deceased clansmen to the number of two or three each, or otherwise forcibly domicile women abducted in their raids. Perhaps the most noteworthy fact relating to the tribe was their ignorance, up to the day of Lieut-Col. Showers' arrival among them, of the true character of the British Government as the paramount power.

The raids of the Meenas into British territory brought matters to a crisis, and it became necessary to put them down. But in contrast with the unfortunate contests with savage races, which are going on at the present day in other parts of the world, it may not be unworthy of note that the tranquillisation of Jehazpoor was effected without a shot being fired.

## CRYSTALLOGRAPHY

### Crystals of Potassic Racemate

ACCORDING to De la Provostaye, potassic racemate crystallises in the rhombic system; but M. des Cloiseaux, in a communication to the Annales de Chimie (xvii. 365), disputes the truth of that statement. All the crystals with which he worked (some being presented to him by Pasteur, some by Lamy and Gernez), are really derived from an oblique rhomboidal prism of 96° 56′. The base of this prism is always highly developed, and its inclined diagonal makes an angle of 92° 28′ with the anterior vertical edge. The plane of the optic axes is perpendicular to the plane of symmetry; the acute bisectrix is negative and normal to $g'$. The *revolving* dispersion is considerable, as shown by the distance which separates the plane where the red axes are situated from that containing the blue. It is easily found by the polarising microscope across fine sections, normal to the acute bisectrix. The *proper* dispersion of the axes is rather strong, with $\rho < \nu$. For their apparent distance in air (at 19)




$$2E = 130\ 2'\ \text{(red rays)};\ 132\ 45'\ \text{(blue rays)}.$$

## ZOOLOGY

### Development of Molgula Tubulosa

IT is well known that the larvæ of the Ascidians generally possess a form resembling, in external appearance at least, that of the tadpoles of our common Frogs, and also resembling these in the agility with which they swim about by means of their tail-like appendage. In fact, as M. Lacaze Duthiers indicates in a paper just communicated to the Academy of Sciences, this peculiarity of development has for a long time been regarded as characteristic of all the Ascidians. According to the celebrated naturalist just mentioned, *Molgula tubulosa* forms an exception to this general rule. Instead of exhibiting the brisk, jerking movements of the embryos of the *Phallusiæ* for example, the embryo of *Molgula* moves very slowly within its egg-capsule, its movements consisting chiefly of alterations in its general form which, however, finally effect the rupture of the capsule. Through this opening the embryo *flows*, like a plastic, amœboid mass, which remains quietly at the bottom of the vessel, merely changing its form slowly by amœboid movements. Soon after exclusion the embryo shows indications of zones in its body, and from the outermost of these processes are given off (for some time only five in number), which seem to fix it to surrounding objects and are analogous to the innumerable filaments of the tunic in the adult.

## SCIENTIFIC SERIALS

THE May number of Silliman's *American Journal of Science and Arts* (vol. xlix. No. 147) opens with a paper by E. W. Blake, jun., on a method of producing, by the electric spark, figures similar to those of Lichtenberg. His method consists in throwing the discharge upon the surface of a fusible non-conducting body, of which common pitch, coating a plate of tin, seems to furnish the best results. Figures produced by means of friction and induction sparks are represented by woodcuts. Col. J. J. Woodward publishes an important paper on the application of the magnesium and electric lights to photomicrography, illustrated with figures showing the arrangement of the apparatus. An anonymous writer, using the initials J. H. B. L., describes and figures a new form of mechanical finger for the microscope. The chemical papers are as follows:—Combinations of silicon with alcoholic radicals, by C. Friedal and J. M. Crafts, a long and valuable paper; analyses of meteoric irons, and remarks on the alkalies contained in leucite, by J. Lawrence Smith the first part of a memoir by B. Silliman and H. Wurtz, on flame temperatures in their relations to composition and luminosity; on some double sulphates of the Cerium group, by C. H. Wing; on two peculiar products in the nickel manufacture, by Joseph Wharton; two short notes by O. Loew, on the action of sunlight on sulphurous acid, and on the formation of ozone by rapid combustion; and two notes on methods to be adopted in gas-analyses by Dr. Wolcott Gibbs. Prof. Arthur Wright notices some curious phenomena observed by him in connection with the discharge of an electrical machine. Natural History proper is represented in this number only by two papers, namely, an account, by H. Y. Hind, of the Laurentian and Huronian series in Nova Scotia and New Brunswick, and descriptions of some new corals, by A. E. Verrill. The latter consist of four Alcyonaria and three Madrepraria, one of which is described as forming a new genus. Besides the usual abstracts and extracted articles placed under the head of Scientific Intelligence, the editors publish an extract from a letter describing the movements produced by a strong gale of wind in the great iron dome of the Capitol of Washington. This is illustrated by a tracing of the pencil mark showing the course of the movement of the centre of the dome.

THE *Revue des Cours Scientifiques* for June 4 gives us M. Berthelot's lecture "on the isomeric states of simple bodies," in which he treats especially of the different states of oxygen, and concludes by observing that there exists, at least in certain cases, a relation between the states of a simple free body (element) and the nature of the combination from which it has been separated; that a simple body in a certain condition can enter more easily into one class of combination than into another class; and that a simple body can change its condition even while it exists in certain combinations. We find also a continuation of M. Bernard's lectures on "Suffocation by the fumes of charcoal," and an address by M. C. Robin, entitled, "How the parts of an organism adapt themselves to determinate purposes." The number for June 11 is mainly occupied by the description of a contrivance by means of which a locomotive can be made to act as a drag or arrester of motion in the train, when such is the will of the driver. We have also a report of Prof. Helmholtz's lecture before the Society of Natural and Medical Sciences at Heidelberg, on "the physiological action of electric currents of short duration in the interior of extensive conducting masses."

THE *Journal of Botany, British and Foreign*, for June hardly sustains the interest of the earlier numbers of the new series. The original articles are confined to a continuation of the Hon. J. L. Warren's paper on the British *Rubi*, and of Mr. Worthington Smith's *Clavis Agaricinorum*, and an article of considerable interest to geographical botanists and theorists on the origin of species, "On the World-Distribution of the British *Caryophyllaceæ*," by Mr. J. G. Baker. We have besides a biography (with portrait) of the late Dr. Franz Unger, and some extracts and shorter notes.

THE best article in the May number of the *American Entomologist and Botanist*, is one which is neither entomological nor botanical, "On the Gordius or Hair-worm," by Prof. Jos. Leidy, of Philadelphia, giving an account of the anatomical structure of the animal, its mode of propagation, and of the different species found in the United States. There are several other articles and an abundance of shorter notes, that will be of value to the young naturalist.

THE *Geological Magazine* for June commences with an article by Prof. Harkness, on "Elephant-remains in Ireland," which have now been met with in several localities. The writer mentions incidentally that Ireland has afforded hitherto no traces of either the hyæna or lion; the pleistocene carnivora were confined to the bear, of which, however, there are no historical records, and the wolf, which was finally extirpated about the year 1710. Prof. de Koninck contributes a paper "On some new and remarkable Echinoderms from the British Palæozoic rocks, including a species of *Palæchinus*; a new species and new genus, *Placocystites Forbesianus*, belonging to the family of *Cystideæ*; and a new species of *Haplocrinus*, *H. granatum*." Mr. T. G. Bonney, "On supposed *Pholas*-burrows in Derbyshire," believes these burrows to have been made by a *Helix*. Mr. J. W. Laidlay describes a "Prehistoric Dwelling and Kitchen-midden on the Coast of Haddingtonshire," in which were found a very large quantity of rude pottery in fragments, and, for the most part, roughly moulded by the hands; a number of implements of bone, such as needles, arrowheads, combs, knives, chisels, &c.,

very similar to those found in the Swiss lakes; a vast quantity of bones of oxen (of several varieties, including *Bos longifrons*), sheep, goats, deer, swine, dogs, &c.; of shells a great abundance, especially those of the *Patella* and *Liottrina;* a very rude querne, &c. They are considered to belong to an age as remote as the Roman period, or perhaps extending even beyond it. Mr. J. Croll concludes his account of "The Boulder-clay of Caithness, a product of land-ice," and Mr. C. Lapworth his valuable paper "On the Silurian rocks of Galashiels." Mr. Croll considers that nearly the whole of the North Sea, between Scandinavia and Scotland, was filled with glacier ice at the time of the formation of the boulder-clay of Caithness; and he indicates facts in the glaciation of the Orkney, Shetland, and Faroe Islands which certainly go a long way in support of his views. It is also to this enormous extension of ice that he ascribes that of the Loess, by the damming up of the waters of the Rhine and Elbe. Mr. Croll's paper is illustrated with a map.

*Annales de Chimie et de Physique.* April, 1870.—This number contains a long and valuable paper by M. Berthelot on the Varieties of Carbon. He commences by pointing out the specific heats of five different kinds of carbon, and comparing them with the specific heat of the element as deduced from that of its gaseous compounds, and shows that the relations between specific heat and atomic weight are not the same as those observed in the case of other elements. He then explains his process for distinguishing and separating the varieties of carbon by treatment with nitric acid and potassic chlorate, and describes the products obtained from carbons of different origin, enumerating no less than thirteen different varieties of the element. The next two sections describe the effects of various agents on carbon, and the carbon obtained from different compounds; concluding with the observation that the kinds of carbon differ so widely in their properties, re-actions, and specific heats as almost to warrant their being considered as different elements. The four following papers are also by M. Berthelot. The first is on the oxidation of hydrocarbons by a strong solution of chromic acid, under which circumstances ethylene produces aldehyde, propylene gives acetone, amylene forms complex bodies, probably derived from an acetone, acetylene produces carbonic, formic, and acetic acids, whilst from camphene camphor is obtained. The second describes a new synthesis of phenol, by treating acetylene with fuming sulphuric acid, thus preparing acetyleno-sulphuric acid and decomposing the potassium salt with fusing potassic hydrate. It appears that at the moment of the liberation of the acetylene from the sulpho-salt three molecules condense and oxidise at the same time. The third paper is on the action of potassic hydrate on the sulphuric derivatives of the hydrocarbons, in which the author describes the products obtained from several of the sulpho-acids. He endeavoured to prepare methylene from sodic formeno-sulphate, but without success, and in consequence of the numerous experiments which he has made he thinks that chemists must give up hopes of its existence. The last paper is on a new synthesis of acetic acid by means of acetylene. The author has discovered several processes which effect this transformation. The last method is by digesting acetylenic dichloride with alcoholic or aqueous solution of potassic hydrate, when potassic acetate and chloride are formed. Acetylenic tetrachloride with alcoholic potash at 100° gives glycolic acid, and with aqueous potash at 230° oxalic acid.

## SOCIETIES AND ACADEMIES

### LONDON

**Royal Society, May 19.**—"Spectroscopic Observations of the Sun." No. VI. By J. Norman Lockyer, F.R.S.

The weather has lately been fine enough and the sun high enough, during my available observation-time, to enable me to resume work. The crop of new facts is not very large, not so large as it would have been had I been working with a strip of the sun, say fifty miles or a hundred miles wide, instead of one considerably over 1,000—indeed, nearer 2,000 in width; but in addition to the new facts obtained, I have very largely strengthened my former observations, so that the many hours I have spent in watching phenomena, now perfectly familiar to me, have not been absolutely lost.

The negative results which Dr. Frankland and myself have obtained in our laboratory-work in the matter of the yellow bright line, near D, in the spectrum of the chromosphere being a hydrogen line, led me to make a special series of observations on that line, with a view of differentiating it, if possible, from the line C.

It had been remarked, some time ago, by Prof. Zollner, that the yellow line was often less high in a prominence than the C line; this, however, is no evidence (bearing in mind our results with regard to magnesium). The proofs I have now to lay before the Royal Society are of a different order, and are, I take it, conclusive:—

1. With a tangential slit I have seen the yellow line bright below the chromosphere, while the C line has been dark; the two lines being in the same field of view.

2. In the case of a bright prominence over a spot on the disc, the C and F lines have been seen bright, while the yellow line has been invisible.

3. In a high-pressure injection of hydrogen, the motion indicated by change of wave-length has been less in the case of the yellow line than in the case of C and F.

4. In a similar quiescent injection the pressure indicated has been less.

5. In one case the C line was seen long and unbroken, while the yellow line was equally long, but broken.

The circumstance that this line is so rarely seen dark upon the sun makes me suspect a connection between it and the line at 5015 Angström, which is also a bright line, and often is seen bright in the chromosphere, and then higher than the sodium and magnesium lines, when they are visible at the same time; and the question arises, must we not attribute these lines to a substance which exists at a higher temperature than those mixed with it, and to one of very great levity? for its absorption-line remains invisible, as a rule, in spot-spectra.

I have been able to make a series of observations on the fine spot which was visible when I commenced them on April 10th, not far from the centre of its path over the disc. At this time, the spot, as I judged by the almost entire absence of indications of general absorption in the penumbral regions, was shallow, and this has happened to many of the spots seen lately. A few hours' observation showed that it was getting deeper apparently, and that the umbræ were enlarging and increasing in number, as if a general down-sinking were taking place; but clouds came over, and the observations were interrupted.

By the next day (April 11) the spot had certainly developed, and now there was a magnificently bright prominence, completely over the darkest mass of umbra, the prominence being fed from the penumbra or very close to it, a fact indicated by greater brilliancy than in the bright C and F lines.

April 12. The prominence was persistent.

April 15. Spot nearing the limb, prominence still persistent over spot. At eleven I saw no prominence of importance on the limb, but about an hour afterwards I was absolutely startled by a prominence not, I think, depending upon the spot I have referred to, but certainly near it, more than 2′ high, showing a tremendous motion towards the eye. There were light clouds, which reflected to me the solar spectrum, and I therefore saw the black C line at the same time. The prominence C line (on which changes of wave-length are not so well visible as in the F line) was only coincident with the absorption-line for a few seconds of arc!

Ten minutes afterwards the thickness of the line towards the right was all the indication of motion I got. In another ten minutes the bright and dark lines were coincident.

And shortly afterwards what motion there was was towards the red!

I pointed out to the Royal Society, now more than a year ago,* that the largest prominences, as seen at any one time, are not necessarily those in which either the intensest action or the most rapid change is going on. From the observations made on this and the following day, I think that we may divide prominences into two classes:—

1. Those in which great action is going on, lower vapours being injected; in the majority of cases these are not high, they last only a short time—are throbs, and are often renewed, and are not seen so frequently near the sun's poles as near the equator. They often accompany spots, but are not limited to them. These are the intensely bright prominences of the American photographs.

2. Those which are perfectly tranquil, so far as wave-length evidence goes. They are often high, are persistent, and not very bright. These do not, as a rule, accompany spots. These

* Proc. Roy. Soc. 1869, p. 354, Mar. 17.

are the "radiance" and dull prominences shown in the American photographs.

I now return to my observations of the spot. On the 16th, the last of the many umbræ was close to the limb, and the most violent action was indicated occasionally. I was working with the C line, and certainly never saw such rapid changes of wave-length before. The motion was chiefly horizontal, or nearly so, and this was probably the reason why, in spite of the great action, the prominences, three or four of which were shut out, never rose very high.

I append some drawings, made, at my request, by an artist, Mr. Holiday, who happened to be with me, and who had never seen my instrument or the solar spectrum widely dispersed before. I attach great importance to them, as they are the untrained observations of a keen judge of form.

The appearances were at times extraordinary and new to me. The hydrogen shot out rapidly, scintillating as it went, and suddenly here and there the bright line, broad and badly defined, would be pierced, as it were, by a line of intensely brilliant light parallel to the length of the spectrum, and at times the whole prominence spectrum was built up of bright lines so arranged, indicating that the prominence itself was built up of single discharges, shot out from the region near the limb with a velocity sometimes amounting to 100 miles a second. After this had gone on for a time, the prominence mounted, and the cyclonic motion became evident; for away from the sun, as shown in my sketch, the separate masses were travelling away from the eye; then gradually a background of less luminous hydrogen was formed, moving with various velocities, and on this background the separate "bombs" appeared (I was working with a vertical spectrum) like exquisitely jewelled ear-rings.

It soon became evident that the region of the chromosphere just behind that in which the prominence arose, was being driven back with a velocity something like twenty miles a second, the back-rush being so local that, with the small image I am unfortunately compelled to use, both the moving and rigid portions were included in the thickness of the slit. I saw the two absorption-lines overlap.

These observations were of great importance to me; for the rapid action enabled me to put together several phenomena I was perfectly familiar with separately, and see their connected meaning.

They may be summarised as follows, and it will be seen that they teach us much concerning the nature of prominences. When the air is perfectly tranquil in the neighbourhood of a large spot, or, indeed, generally in any part of the disc, we see absorption-lines running along the whole length of the spectrum, crossing the Frauenhofer lines, and they vary in depth of shade and breadth according as we have pore, corrugation, or spot under the corresponding part of the slit—a pore, in fact, is a spot. Here and there, where the spectrum is brightest (where a bright point of facula is under the slit) we suddenly see this appearance —an interesting bright lozenge of light. This I take to be due to bright hydrogen at a greater pressure than ordinary, and this then is the reason of the intensely bright points seen in ranges of faculæ observed near the limb.

The appearance of this lozenge in the spectroscope, which indicates a diminution of pressure round its central portion, is the signal for some, and often all, of the following phenomena :—

1. A thinning and strange variation in the visibility and thickness of the hydrogen absorption-line under observation.

2. The appearance of other lozenges in the same locality.

3. The more or less decided formation of a bright prominence on the disk.

4. If near the limb, this prominence may extend beyond it, and its motion-form will then become more easy of observation. In such cases the motion is cyclonic in the majority of cases, and generally very rapid, and—another feature of a solar storm—the photospheric vapours are torn up with the intensely bright hydrogen, the number of bright lines visible determining the depth from which the vapours are torn, and varying almost directly with the amount of motion indicated.

Here, then, we have, I think, the chain that connects the prominences with the brighter points of the faculæ.

These lozenge-shaped appearances, which were observed close to the spot on the 16th, were accompanied by the "throbs" of the eruption, to which I have before referred; while Mr. Holiday was with me—a space of two hours—there were two outbursts, separated by a space of almost rest, and each outburst consisting of a series of discharges, as I have shown. I subsequently witnessed a third outburst. The phenomena observed on all three were the same in kind.

On this day I was so anxious to watch the various motion-forms of the hydrogen-lines, that I did not use the tangential slit. This I did the next day (the 17th of April) in the same region, when similar eruptions were visible, though the spot was no longer visible.

Judge of my surprise and delight, when upon sweeping along the spectrum, I found HUNDREDS of the Frauenhofer lines beautifully bright at the base of the prominence ! ! !

The complication of the chromosphere spectrum was greatest in the regions more refrangible than C, from E to long past *b*, and near F, and high pressure iron vapour was one of the chief causes of the phenomenon.

I have before stated to the Royal Society that I have seen the chromosphere full of lines; but the fulness then was as emptiness compared with the observation to which I now refer.

A more convincing proof of the theory of the solar constitution, put forward by Dr. Frankland and myself, could scarcely have been furnished. This observation not only endorses all my former work in this direction, but it tends to show the shallowness of the region on which many of the more important solar phenomena take place, as well as its exact locality.

The appearance of the F line, with a tangential slit at the base of the prominence, included two of the lozenge-shaped brilliant spots to which I have before referred; they were more elongated than usual—an effect of pressure, I hold, greater pressure and therefore greater complication of the chromosphere spectrum; this complication is almost impossible of observation on the disc.

It is noteworthy that in another prominence, on the same side of the sun, although the action was great, the erupted materials were simple, *i.e.*, only sodium and magnesium, and that a moderate alteration of wave-length in these vapours was obvious. Besides these observations on the 17th, I also availed myself of the pureness of the air to examine telescopically the two spots on the disc, which the spectroscope reported tranquil as to up and down rushes. I saw every cloud-dome in their neighbourhood perfectly, and I saw these domes drawn out, by horizontal currents, doubtless, in the penumbræ, while on the floors of the spots, here and there, were similar cloud-masses, the distribution of which varied from time to time, the spectrum of these masses resembling that of their fellows on the general surface of the sun.

I have before stated that the region of a spot comprised by the penumbræ appears to be shallower in the spots I have observed lately (we are now nearing the maximum period of sun spots); I have further to remark that I have evidence that the chromosphere is also shallower than it was in 1868.

I am now making special observations on these two points, as I consider that many important conclusions may be drawn from them.

**Zoological Society**, May 26.—G. R. Waterhouse, V.P., in the chair. A letter was read from Mr. W. H. Hudson, C.M.Z.S., containing remarks on birds observed in and around Buenos Ayres, being the fourth communication received from this gentleman on the same subject.—Mr. R. B. Sharpe exhibited and made remarks on a specimen of a rare Asiatic bird, *Podoces panderi*, from the collection of Lord Lilford.—Professor Owen read the sixteenth of a series of memoirs on *Dinornis*, containing an account of the trachea and of some other internal organs of certain species of this genus, together with a description of the brain and some nerves and muscles of the head of *Apteryx australis*.—Dr. J. Murie read a paper on the anatomy of the Prongbuck (*Antilocapra americana*), founded on the examination of the specimen of this animal which had died in the Society's Gardens in the year 1867.—A communication was read from Dr. A. B. Meyer, containing remarks on the poisonous glands of the snakes of the genus *Callophis*, being supplementary to his paper on the same subject published in the *Monatsberichte* of the Academy of Berlin.—A communication was read from Surgeon Francis Day, F.Z.S., containing notes on some fishes from the western coast of India, amongst which were several species described as new to science.—Mr. H. Adams communicated the descriptions of some new species of land and fresh-water shells obtained by Mr. E. Bartlett in Eastern Peru, and by Mr. R. Swinhoe in China and Formosa. Mr. Adams also described two new species of land shells from Africa.

**Aeronautical Society**, June 3.—Mr. James Glaisher, F.R.S., in the chair. Several papers were read and illus-

trated by models. An instrument for ascertaining the connection between velocity and pressure, exhibited by Dr. Smyth, of Maidstone, procured the encomiums of the chairman, who stated that it was calculated to supply information that was wanting in the instrument which he had been using. In the course of discussion, Mr. A. Stewart Harrison strongly advocated the necessity of an experimental fund, whereupon the chairman asked Mr. Fred. W. Brearey, the honorary secretary, to read the minutes of a late council meeting at Stafford House, at which were present Mr. Glaisher (in the chair), Sir William Fairbairn, Bart., Mr. Brook, Mr. Wright, Mr. Wenham, Mr. Oheen, and Mr. Brearey; as follows:—Sir William Fairbairn observed that we know but little of the re-action or lifting power of various forms of screw blades in the atmosphere relative to the force employed, though such experiments might be easily tried and the data obtained. Mr. Brook was of opinion that if a successful aerial machine was to be constructed, the most simple and obvious plan was that of inclined surfaces impelled forward horizontally. The most successful experiment that he had ever witnessed was upon this principle, the motive power being a wound-up clock spring, which, as long as the power lasted, sustained the machine, and further that most large birds were capable during long periods of their flight of sustaining themselves exactly in this way. It was further remarked that we were practically ignorant of the correct laws of the sustaining power of inclined surfaces of different forms and areas, and this want of knowledge was a perpetual stumblingblock to those who were wishing to spend time and money on experiments. From the fact that, as the weight and size of birds increased, so did the relative wing area decrease, it would appear that the ratio of sustaining surface to weight or resistance was by no means in equal proportion. The Chairman stated that with respect to plane surfaces of various figures exposed to the direct impact of the wind, he had already been trying some experiments with such instruments as were at his disposal, and that by employing two anemometers at the same time, so as to be sure of comparative results, he found that the indication of force increased with the size of the surface; also in the two instruments, equal surfaces shaped into different contours gave different results. These interesting experiments, so directly bearing upon the question of aerial propulsion and resistance, were still occupying his attention; but at present he could tell us nothing from actual experiment of the resistance of inclined surfaces of various forms. It was then proposed that an experimental fund should be raised by subscription, and that a suitable and well finished anemometer should be constructed, having the means of instantly setting various plane surfaces at any desired angle, and capable of registering both horizontal and vertical force simultaneously for all degrees of inclination. The results to be published for the benefit of the Society." Upon this proposition being put to the meeting, it was carried unanimously.

**Ethnological Society,** June 1.—Special Sectional Meeting at the Royal United Service Institute. Prof. Huxley, F.R.S. president, in the chair.—A letter was read from Lieut. Oliver, relative to the recent destruction of a cromlech in Jersey.—Col. Lane Fox read communications from Dr. Caulfield, "On the discovery of copper celts near Buttevant, Co. Cork;" and on a supposed Ogham inscription from Rus-glass, Co. Cork.—Mr. C. Spence Bate, F.R.S., then presented an elaborate "Report on the prehistoric antiquities of Dartmoor," forming one of the series of reports being now collected by the Society, with a view to obtaining accurate information on the present condition of the megalithic monuments of this country. After noticing the physical features of the district, the author described in detail the numerous stone circles, avenues, menhirs, cromlechs, cairns, and other prehistoric monuments of Dartmoor. He suggested the idea that the stones in some of the avenues may have been erected in commemoration of the death of persons of distinction, one being added for each burial. The depressions on the summit of some of the cairns were regarded rather as indications of unfinished work than of subsequent disturbance by treasure-seekers. Evidence was adduced of the wanton destruction of the granite blocks in some of the cromlechs; and both in the paper and in the subsequent discussion attention was forcibly directed to the importance of obtaining legislative protection to these prehistoric monuments. A large series of diagrams, plans, coloured sketches, photographs, and specimens illustrated this valuable communication. The discussion was sustained by Mr. W. Morrison, M.P., Mr. Moggridge, Mr. Hyde Clarke, Mr. Black, Rev. G. St.-Clair, Dr. Campbell, and Mr. Lewis.

**Chemical Society,** June 2.—Prof. Williamson, F.R.S., president, in the chair. Mr. W. B. Tustin was elected a Fellow.—Prof. Odling, F.R.S., delivered a lecture "On the Platinum Ammonia compounds." Platinum combines with chlorine in two proportions, viz., with four atoms of chlorine to form platinic chloride, $Pt\,Cl_4$, and with two atoms of chlorine to form platinous chloride, $Pt\,Cl_2$. All the platinum ammonia compounds are produced in first instance from the plantinous chloride, none of them directly from the platinic chloride. If this is borne in mind, a great simplicity will at once be introduced into the study of the platinum ammonias. Next, the lecturer proceeded to show the manifestations of the atomicities of nitrogen, boron, silicon, and platinum as illustrated in the compounds $NH_3\,HCl$, $BF_3\,KF$, $SiF_4\,K_2\,F_2$, and $Pt\,Cl_4\,K_2Cl_2$, which four compounds are decidedly analogous, and deduced from this as well as from many other evidences the necessity of writing the formula of sal-ammoniac $NH_3\,HCl$, and not $NH_4\,Cl$. Having established this, the metallic derivatives of sal-ammoniac were ranged into two sets—those in which the metal can be detected by the usual tests, and those in which this cannot be done; the first may be typified by the formula $NH_3\,m\,Cl$, the second by $NH_2\,m\,HCl$. [The small letter indicates that quantity of a metal which occupies the place of one atom of hydrogen.] The lecturer then extended his comparison of the manifestations of the pentad nature or the pendacity of nitrogen with those of the tetradicity of carbon, and concluded this kind of preface by reminding of the necessity of studying mineral chemistry in the light of organic chemistry. He then gave a short history of the platinum ammonia compounds, beginning with the so-called green salt of Magnus discovered in 1828, mentioning the salts prepared and described by Gros, Reiset, Peyronne, and others, and finally by stating Laurent and Gerhardt's latest arrangements for classifying these compounds. That classification is now by no means satisfactory, and Dr. Odling hopes to bring forward at some future meeting his own views on this subject.

**Anthropological Society,** May 31.—Dr. R. S. Charnock, vice-president, in the chair. Mr. George Thorne Ricketts, Her Majesty's consul, Manila, was elected a Fellow.

A paper by Dr. John Shortt was read on "The Armenians of Southern India." Early in the sixteenth century a few Armenians found their way into Southern India with the countenance and support of the Hon. East India Company, and under a contract with the company equal privileges with British subjects were conceded to the Armenians. The company further extended favours to them when they reached, in any town, the number of forty, by the provision of a place of worship, and by annual grants of money. For a long time after their arrival in India they avoided mingling with other people, but latterly that rule has been broken through, and alliances in marriage with Europeans are not unfrequent. The Armenians have diminished in numbers, and, it is said, are daily decreasing in influence. The chief causes of their approaching extinction in India appear to be the vice of intemperance, the taint of disease, and the contact with Europeans, more especially the English. The physical and moral characteristics were described; in the former it was stated that the Armenians are strongly allied to the Jewish race, from which they claim descent.

A paper by Mr. John Stirling, M.A., was read on "The Races of Morocco." The inhabitants of that part of Barbary known as Morocco may be arranged under the following heads, viz, Berbers, Al-Ryf, Arabs, Bohára troops, and other Negroes or half-breeds, and Jews. The word *Kabyles* often erroneously used to designate some North African race, is a term applied by the Moors to distinguish villagers or country people engaged in agriculture. The Berbers are probably of Phœnician blood mixed with an old race indigenous to Morocco; at any rate, the remains of dolmens and other monuments would point to that origin. The Al-Ryf are wild descendants of the Ryf pirates, the inhabitants of the northern spurs of the Atlas range which separates Morocco from Algeria. The Al-Ryf are comparatively a fair people, and such of them as follow in-door occupations exhibit a delicate olive complexion. The Bohára troop form a remarkable race; their ancestors were a rebellious Negro tribe living south of the Atlas. They have married with Moorish women, but still retain to a great degree the Negro aspect. The Negroes of Morocco have intermarried with the fair Moors, and produced a mixed race. The true Moors are fair, some individuals having blue eyes and light or red hair.

Sir Duncan Gibb, Bart., M.D., in a paper "On the Paucity of Aboriginal Monuments in Canada," attributed the absence in

Canada of monuments built of stone to the peculiar character of the climate, which would be unfavourable to their preservation. He anticipated the discovery some day of traces of the ancient inhabitants in the great caverns north of Flamborough, and in the island of Anticosti.

**Institution of Civil Engineers**, May 17.—Charles B. Vignoles, F.R.S., president, in the chair. The paper read was "On recent improvements in regenerative hot-blast stoves for blast furnaces," by Mr. E. A. Cowper, M. Inst. C.E. The author stated that when, in 1828, the late Mr. J. B. Neilson, M. Inst. C.E., introduced the plan of heating the air employed as blast, by means of iron pipes placed in or near a fire, the increase of temperature was at first only from 60° to 100° Fahr. Subsequently, Mr. Neilson obtained a temperature of 600° or 650° and the pipe stoves had since been urged up to 900°, and in a few cases to 1100°. The wear and tear, however, with such temperatures of blast were considerable; there was great loss of heat by conduction, and the pipe stoves were, as a rule, worked in a leaky condition, necessitating the expenditure of engine power for blowing air uselessly. The improvements described in the paper were based upon Mr. Siemens' regenerative furnace. Each stove of a pair consisted of a wrought-iron cylindrical casing, lined with fire-brick, and provided with a central shaft or flue, which extended to within a few feet of the brick dome forming the top. Around this shaft there were a number of compartments, or boxes, formed of bricks so placed that those in one course were not exactly coincident in position with those in the courses either above or below, though a passage was left open from the bottom to the top of the mass of brickwork. This wrought-iron casing was provided with several valves, three being for the cold blast, of gas, and of air for combustion, and two being for the exit of the hot blast and of the products of combustion. When a stove had been at work heating blast, and it was wanted to reheat it, the first thing to be done was to put another stove in operation, then to shut the hot and the cold blast valves, allowing the air in the stove to be blown out at a small valve to reduce it to atmospheric pressure. The gas, air, and chimney valves were next opened, and the gas, igniting as it entered, gave a large volume of flame right up the central shaft and over and into the regenerator, thus heating the top course of brickwork considerably, the next course rather less, and so on, the products of combustion passing away to the chimney at a temperature of about 300°. In the course of a few hours a large amount of caloric was stored up in the bricks forming the regenerator, a good red heat penetrating nearly to the bottom, when the stove was again ready to heat the blast to a temperature of 1,400° or 1,500°. In these stoves the cost of dust catchers was avoided, and the expense of producing gas was also saved, as the gas was used direct from the top of the blast furnace, and the stoves could be cleaned out with the greatest facility. The construction of the regenerator in compartments or boxes, connected together vertically but not horizontally, gave the power of applying the blast with efficiency (inasmuch as the whole force of the blast was confined to the one passage that was being blown at the time), and admitted of a brush being passed up or down the boxes to remove the dust. The form and proportion of the passages had been found, after numerous experiments, to produce an excellent effect in mixing the air, thereby ensuring a rapid and perfect conduction of heat from the bricks to the air, or *vice versa*, from the products of combustion to the bricks. The results obtained by Messrs. Cochrane from the adoption of these stoves at Ormesby, as regarded the quality of iron, the increased make, and the saving of coke in the blast furnace, had been most satisfactory. Thus there was a saving of 4 cwt. of coke per ton of iron produced, by the use of the regenerative stoves for heating the blast, when compared with good cast-iron pipe stoves, and the saving was still more over ordinary pipe stoves. With a large furnace, producing 475 tons a week, the first cost of these stoves was somewhat less than the cost of pipe stoves, while the expense of working was less, so that the profit, taking everything into account, was estimated to amount to about 4,162*l.* a year.

### CAMBRIDGE

**Philosophical Society**, May 16.—Professor W. Cayley, president, in the chair. The following communications were made to the Society:—

(1.) By Mr. Sedley Taylor (Trinity). Mr. Taylor described the nature and classification of musical sounds, their laws and connection, and illustrated experimentally the subject of "beats," and explained at some length, with illustrations, Helmholtz's theory of harmony. The rest of the paper was devoted to a criticism of a theory of consonance given by Professor Tyndall in his published lectures on sound. This theory, he maintained, was, while professing to be that of Helmholtz, a totally different one, in flat contradiction to the facts of experience, and in reality wholly erroneous.

(2.) On a case of asymmetry in the human body, by Professor Humphry. The subject of this paper was a female patient in Addenhook's Hospital, at Cambridge. The asymmetry was very marked, carried out through the whole body; the right arm, for example, being more fully developed, and 2½ inches longer than the left, and extending even to the mammary glands, teeth, tonsils, &c. The subject had always enjoyed good health, was strong, and fully developed. No paralysis had ever been produced by this asymmetry, as had been the case in the instance mentioned by Van der Kolb, a cast of the brain of which was exhibited. Professor Humphry expressed himself wholly unable to account for this instance. As the person was alive and well, of course examination of the internal organs was impossible.

### PARIS

**Academy of Sciences**, June 6.—A considerable number of works and memoirs were received in candidature for various prizes in the gift of the Academy.—M. Chasles presented a note by M. Mannheim, "On the determination of the osculatory plane and radius of curvature of the trajectory of some point in a straight line, which is displaced under certain conditions;" and also a note by MM. F. Klein and S. Lie, "On a certain family of curves and surfaces."—A note was read by M. Des Cloiseaux, "On the optical properties of benzile, and of some bodies of the camphor family, in the crystallised state and in solution." The author has found that crystals of benzile rotated the plane of polarisation in different ways, and the right and left crystals, when dissolved and crystallised two or three times, likewise gave a mixture of crystals with opposite rotations. Solution of benzile in ether has no action on polarised light. Benzile thus possesses optical properties similar to those of periodate of soda. Common camphor in solution deviates the plane of polarisation, whilst its crystals have no action upon polarised light. Camphor of patchouli and mint camphor (menthole), both belonging to the hexagonal system, have a negative, uniaxial, double refraction, and their solutions in alcohol deviate the plane of polarisation to the left. Three camphors belonging to the cubic system, namely, Bornean camphor, terecamphene, and monohydrochlorate of turpentine, have no action on polarised light when crystallised, but in solution strongly deviate the plane of polarisation, the first to the right, the other two to the left.—M. Duchemin described a marine galvanic battery, set in action by contact with sea water. It consists of a thick cylinder of zinc, pierced with holes, and containing a porous vessel, enclosing a carbon element surrounded by powdered coke and perchloride of iron.—An extract of a letter from Father Secchi to M. Fizeau, "On the displacement of the lines observed in the solar spectrum," was read. M. Le Verrier communicated an extract from a letter of M. Winnecke announcing his discovery of a new telescopic comet on the night of the 29-30th May, at Carlsruhe.—Mr. H. Sainte-Claire Deville communicated a second memoir on the action of water on iron and of hydrogen on oxide of iron. In this paper he described his experiments with iron at temperatures of 150°, 265°, 440°, 860°, and 1040° C. (= 302°, 509°, 824°, 1580°, and 1904° F.) and with aqueous vapour at constant and varying tensions.—A paper was read by M. E. Frémy on the reduction of nitrous acid by metals, containing the continuation of his researches on this subject brought under the notice of the Academy on the 10th January (see NATURE, No. 12). He identified the body obtained by the reduction of nitrous acid and the nitrites with the oxy-ammonia of M. Lossen, $N H^3 O^2$ (or N H ²O, HO) and stated that it possessed marked basic properties, and is strongly reductive.—M. de Quatrefages presented a note by M. E. Perrier on the circulation of the Oligochæta of the group Naïdæ, which he described from researches made upon *Dero obtusa*. The circulatory apparatus in this worm consists, according to the author, of a dorsal and a ventral vessel, united by a most complex vascular apparatus which varies considerably in its structure in different regions of the body.—A note by M. Feltz, on the phenomena of which the white globules of the blood, and the walls of the capillary vessels, are the seat during inflammation, was communicated by M. C. Robin.—M. R. Wolf suggested that instead of apply-

ing the decimal mode of division to the quadrant of the circle and the quarter of the day, as proposed by M. D'Abbadie, the whole circle and the whole day should be taken as the unit of division. M. D'Abbadie remarked that the quadrant is the natural unit which has always been adopted for trigonometrical purposes, and indicated some practical inconveniences which would result from a change. Of the remaining communications only the titles are given.

BOSTON

**Natural History Society**, *Section of Microscopy*, Feb. 9.—Dr. B. Joy Jeffries in the chair. The following paper was read:—"Notes on Diatomaceæ," by Professor Arthur Mead Edwards. "A few days since (Sept. 1869) I made a gathering in a ditch communicating with the salt water of the Hudson River, opposite the city of New York, at Weehawken, N. J. Of course the water in the ditch was salt, and, in fact, in it last spring I had caught specimens of Stickleback (*Gasterosteus*) which had come up there from the river to spawn, as is their wont to do. The Ten-spined Stickleback (*G. pungitius*) I had found very plentiful, and mixed with it a few individuals of the Three-spined (*G. aculeatus*); in fact these fish occurred in such numbers that when the water became foul, as it did by evaporation, the bottom of the ditch was literally covered with their dead bodies. The gathering, however, I have to speak of at the present time was made for the purpose of procuring Diatomaceæ, and consisted of specimens of an alga belonging to the genus *Enteromorpha*, having attached to it more or less firmly numerous Diatomaceæ and animals. The commonest form of Diatom was a *Cyclotella*, and seemingly fixed in some manner to the *Enteromorpha*, for it was not shaken off by pretty rough usage. How it was fixed I could not detect; most likely by means of a mucous envelope of such tenuity that it is not readily seen. The next most common form is the truly wonderful, inexplicable *Bacillaria paradoxa*, the paradoxical bundle of sticks. Often and often have I spent hours looking at this marvel of nature; the motion without apparent cause or mode, an invisible joint which, as a friend of mine, an engineer, once remarked, would be a fortune to any one who would discover it, for here we have several sticks forming the bundle, moving over each other without separating, and yet the use of the highest powers of the microscope has failed to detect the means of their union into one mass or composite group of individuals. This grouping of individuals together, which we so commonly find among the Diatomaceæ, as in *Schizonema*, *Achnanthes*, *Melosira*, and a host of other genera, appears to me to have its analogue in the animal kingdom in the Polyzoa; which, although generally fixed, yet at certain periods throw off motile forms by means of which the species is distributed. Do not the Diatomaceæ do likewise? I am of opinion that they do, and I shall produce evidence on that point further on. As to the *Bacillaria paradoxa*, the oftener I watch it the more it puzzles me. Not long since I saw one specimen (of course I mean one bundle of individuals) slide out to its utmost limit across the field of view, and then, becoming entangled with two others, which likewise were made up of many individuals, some eight or ten of its frustules (as the complete individuals are called) were twisted around almost off from the rest, so as to lie at right angles to them, and when the group containing the largest number of frustules receded to their former position, which they soon did, the eight or ten seeming by the act of twisting to lose their power of motion among themselves for the time being, were dragged along in a helpless condition, and twisted completely around one revolution, so as thereafter to fall back again into their places, when all went on as usual. That is to say, the regular motion of all the frustules over each other succeeded. Now what kind of a joint can it be that permits of such eccentric movement? As I have already said, I am more puzzled than ever. Along with the *Bacillaria* in the brackish water at Hoboken, I found numerous individuals of an *Amphora*, which I have known in this neighbourhood for many years, and which I considered unnamed as yet. To it I have given the provisional name of *A. lanceolata*, on account of the form of its outline. This genus has always been considered an epiphytaceous one; that is to say, one which grows attached to other plants or submerged substances, yet this form was free and in active motion. In fact I think it was one of the most lively Diatoms I ever saw. So another small species of *Amphora* which is common near here, is always, as far as I have noticed, free. Here we have species appearing both in the free and attached conditions, and this is even more strikingly illustrated in *Schizonema*. *Bacillaria paradoxa* is usually set down as the most rapid in motion of the Diatomaceæ, its velocity being recorded by Smith, as he measured it, at over one two-hundredth of an inch in a second. This is certainly pretty quick when we consider that the length of the frustule is only ·0025 of an inch. But my experience has been that its velocity varies in every degree from that mentioned to perfect rest; at times some individuals will be in rapid movement, while others are motionless; and also I have remarked that from sunrise to noon seems to be the period during which, under ordinary conditions, the movement is most active, while during the afternoon it is very sluggish, and at night almost *nil*. This *Amphora*, as I saw it at the time mentioned, was moving even more rapidly than I ever saw a *Bacillaria* move, and that with a steady onward progression very different from that of most naviculiform diatoms. Many months since I mentioned at one of the meetings of the Lyceum of Natural History in New York, that I had seen two apparently different genera of Diatoms existing within the same investing tube; and now I wish to place that fact upon record, and to state one or two more instances of the same mode of growth. During the month of March 1868, I found in the harbour of New York specimens of *Schizonema Grevillei* in active motion within their investing tubes, but accompanied by a much smaller form possessing a totally different outline from *S. Grevillei*, being blunter at the ends, and with parallel sides. During the same month, and also in April, I found this mode of occurrence very common, and also *Schizonema Grevillei* and a *Homœocladia* in the same tube, and *Schizonema cruciger* and the small form mentioned above, both in the same tube, and *S. cruciger* and *Grevillei* in the same tube. In all these cases the frustules were in lively motion, passing over each other from one end to the other of the tube. In May of the present year, 1869, I found growing in the salt water of the 'Mill pond' at Salem, Mass., *Schizonema cruciger* and *Nitzschia closterium*, W. S. (*Ceratoneis closterium*, C. G. E., and *Nitzschiella closterium*, L. R.), both in the same tube. And here it will be necessary to say something in regard to the form I have called *Nitzschia closterium*, as I shall thereby, I hope, be enabled to clear away a little fog of synonyms. Neither Smith, Kützing, nor Rabenhorst describes or figures any species living within a tube like *Schizonema*, the frustules of which have an outline and markings similar to *Nitzschia closterium*, so that it is not likely that they ever saw anything but the free form or condition of this species. However, Ehrenberg figures and describes, under the designation of *Schizonema? Agardhii* (*Die Infusionsthierchen*, 1838, p. 343, t. xx. fig. xvi.), a form agreeing with this, but the structure of the frustule is that of *Nitzschiella* of Rabenhorst, so that the specific name of this species should be *Agardhii*, whatever its genus be decided to be hereafter."

March 2.—Dr. C. T. Jackson, vice-president, in the chair. The following papers were presented:—"Description of the Larva and Chrysalis of *Papilio Rutulus* Boisd., of California," by Samuel H. Scudder.—"On the Phosphate Beds of South Carolina," by N. S. Shaler. The latter contains a partial account of the observations made upon this district by the author, while in the employ of the United States Coast Survey, and is published with the permission of the Superintendent of the Survey, Prof. Benj. Pierce, of Cambridge. A portion of the conclusions have a certain commercial as well as scientific value, and it was deemed by the Superintendent desirable to place them before the public at the earliest opportunity. The remainder of the description of these beds will be found in the report of the work of the Coast Survey for 1870.

March 16.—Mr. William T. Brigham in the chair. The following papers were presented:—"Note on the Occurrence of *Euleptorhamphus longirostris* on the Coast of Massachusetts," by F. W. Putnam.—"Revision of the Classification of the Mollusca of Massachusetts," by W. H. Dall, Smithsonian Institution.

NEW YORK

**Lyceum of Natural History**, *Chemical Section*, May 9.—Prof. Charles A. Seely "On the Constitution of Ammoniacal Amalgam." Ammonium amalgam was discovered by Berzelius in 1808; and immediately after by Pontin, Seebeck, and Trommsdorff. Its easy preparation, singular properties, and its relation to current theories, have made it familiar to all chemists. It led to the adoption of Ampere's ammonium theory, gave a great impetus to the theory of organic radicals, and revived the notions of the alchemists of the compound nature of metals. Early in this century it led many to conclude that the base of nitrogen is a metal; and at the present time, without

doubt, has assisted in giving currency to the notion that hydrogen is a metal. Except for it, perhaps the crudity, hydrogenium, would not have been inflicted upon us. Of course it has occupied a conspicuous place in chemical literature; scoresof papers, and at least two books, have been printed about it. The name ammonium amalgam expresses the supposed constitution of the substance; the radical ammonium is represented as dissolved in or united with mercury. The ammonium is, moreover, conceded to be a solid or a liquid, and to have a truly metallic character. Thus the latest and best authorities present the case. It is described, in nearly all treatises on chemistry, as if its constitution was as certainly ascertained as that of common salt. There have been from the beginning, however, those who doubted the prevailing ideas, and some (see Daniel's "Chemical Philosophy," p. 520, and Dr. Wetherill on Ammonium Amalgam, in *Silliman's Journal*, vol. x., p. 160) boldly objected to them, but the reasons they alleged had not sufficient weight. Ammonium amalgam has always been a pet with chemists; it has always been ready for the service of one theory or another. The ammonium theory, the radical theory, the nitrogen and hydrogenium theories, have each in their turn been of too much importance to permit any of their props to be withdrawn.

The author considers the so-called ammonium amalgam to be a mechanical or physical mixture of liquid mercury with the gases ammonia and hydrogen, and that its semi-solid consistence is due to the mixture having the nature of a froth. When sodium-amalgam is brought into a solution of sal-ammoniac (the ordinary method of preparing ammonium amalgam) the chlorine combines with the sodium, and the residue ($NH_3 + H$) of the sal-ammoniac is set free all over the surface of the mercury. The particles of the mixed gases adhere to the mercury, and by reason of the movement bringing to the surface fresh mercury, they become enfilmed and carried inward, until the mixture becomes a homogeneous froth. The principal considerations by which this view of the constitution of ammonium amalgam has been reached, are as follows:—

1. The volume of ammonium amalgam is inexplicable in any other way; it is utterly inconsistent with the well-established laws of combinations by volume. There is no case of a liquid or solid chemical compound, or amalgam, which has any analogy to it.

2. Mercury has a mirror-like surface, while ammonium amalgam has comparatively a whiter and more dead surface; it approaches in appearance to matt silver. Such changes are characteristic of froths.

3. If ammonium amalgam be subjected to varying pressure, its volume changes apparently in accordance with Mariotte's law of gaseous volume. To illustrate this important fact, a glass tube one-third inch in diameter, twenty inches long, and fitted with a plunger, was employed. Mercury containing a little sodium was poured into the tube to one-third of an inch in depth, and upon this was poured a strong solution of chloride of ammonium, occupying about two inches in length of the tube. The ammonium amalgam was completely formed in a few minutes, and occupied several inches of the tube. On adjusting and depressing the plunger, the volume of the amalgam progressively diminished till it closely approached the original volume of the amalgam. Also it was notable that the amalgam progressively gained fluidity and the mirror surface, till at the greatest pressure it appeared like mercury. On withdrawing the pressure the original volume and appearance of the compound were resumed, and on reducing the pressure below that of the air, the amalgam still expanded, until it rose above the surface of the liquid in the tube. If the great pressure be maintained, more ammonium amalgam will be formed, the mass expanding progressively, apparently in accordance with the fact that the absorption or adhesion of gases to liquids is favoured by pressure. By means of the simple apparatus used a pressure of ten atmospheres, or a good vacuum, is easily and at once attainable, and the experiments with it are very striking.

The so-called ammonium amalgam is therefore not an amalgam at all; ammonium is not proved to be a metal, and if it be admitted that the monatomic radical really exists in ammonium amalgam, it is neither a solid nor a liquid, but a gas.

The considerations regarding ammonium amalgam are evidently equally applicable to Loew's hydrogenium amalgam; both are only metallic froths. The expansion of palladium observed by Graham, on its absorption of hydrogen, is probably analogous to the case in question. In both cases the gases concerned are condensed by reason of their attraction to the metal; and if the molecules of palladium were made free to move, as those of mercury, it is probable that Graham's hydrogenium alloy would become a palladic froth, more remarkable than the corresponding mercuric froth. Many have erroneously supposed that hydrogen was conspicuous in its capability of being absorbed by metals, and thus have more readily been infused with the hydrogeninm theory. Oxygen has an eminence over hydrogen in that property, and yet no one has a theory of oxygenium. Iron absorbs carbonic oxide, but no one is bold enough to suggest that carbonic oxide is a metal.

## DIARY

*THURSDAY*, June 16.

Royal Society, at 8.30.—Papers to be read by Dr. Hofmann, F.R.S.; Dr. H. E. Armstrong, Dr. Alex. Rattray, Prof. Macalister, C. Tomlinson, F.R.S., W. Huggins, F.R.S., Sir Edward Sabine, P.R.S., the Earl of Rosse, F.R.S., Dr. Stenhouse, F.R.S., G. Busk, F.R.S., the Hon. J. W. Strutt, Mr. J. Broughton, Mr. A. Le Sueur, and W. H. L. Russell, F.R.S.

Royal Society of Antiquaries, at 8.30.—On Heydon Church, Yorkshire: Mr. G. E. Street.

Linnean Society, at 8.—On two Species of Serapias which occasionally present semi-labelliform lateral sepals: Mr. J. T. Moggridge.

Chemical Society, at 8.

Numismatic Society, at 7.—Anniversary Meeting.

*SUNDAY*, June 19.

Sunday Lecture Society, at 8.—On Volcanoes: Mr. D. Forbes.

*MONDAY*, June 20.

London Institution, at 4.—Botany: Prof. Bentley.

*TUESDAY*, June 21.

Statistical Society, at 8.—On Free Libraries: Mr. W. E. A. Axon.

Ethnological Society, at 8.30 (at the Royal United Service Institution, Whitehall Yard).—On the Aymara Indians of Bolivia and Peru: Mr. D. Forbes.

*WEDNESDAY*, June 22.

Geological Society, at 8.

*THURSDAY*, June 23.

Zoological Society, at 8.30.—On the Walrus: Dr. J. Murie.—Catalogue of the Mammals of South China and Formosa: Mr. R. Swinhoe.—On a Collection of Birds from the Island of Trinidad: Dr. O. Finsch.

## BOOKS RECEIVED

English.—On Diamagnetism and Magne-Crystallic Action: Prof. Tyndall (Longmans and Co.).—Notes on Light: Prof. Tyndall (Longmans and Co.).—Grave-mounds and their Contents: L. Jewitt (Groombridge and Sons).—Gymnastics for Ladies: Madame Brenner.—First Principles of Chemical Philosophy: J. P. Cooke, jun. (Macmillans).

Foreign.—(Through Williams and Norgate).—Annales de Chimie et de Physique: Chevreul et Dumas, Tome xx.—Zeitschrift für Ethnologie, 1870, Heit II.—Ueber die Entstehung der Welt: C. S. Cornelius.—Lehrbuch der Chemie: A. Genther.—Histoire des Poissons: Aug Duméril. Tome ii. et Atlas.—Charles Darwin et ses précurseurs francais: A. de Quatrefages.

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